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CHEMICAL & ENGINEERING

NEWS

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World Chemical Outlook

Page 22

News of the Week

■ **Plan for first five years of program to map and sequence human DNA has been drafted by NIH's human genome committee.** Page 4

■ **Cutbacks in chemical weapons were among several major proposals to come out of the Malta meeting between President Bush and Soviet President Gorbachev.** Page 5

■ **New method for generating large numbers of monoclonal antibody fragments that could replace present hybridoma technology has been developed by researchers at Scripps and Penn State.** Page 5

■ **Du Pont is consolidating its waste treatment and safety operations into a new business, called Safety and Environmental Resources, and expects it to grow into a lucrative endeavor.** Page 6

■ **Many federal programs, a number of them science-related, are highly vulnerable to fraud, waste, and abuse, the White House Office of Management & Budget finds.** Page 6

Business

Growth in U.S. polystyrene demand is expected to continue to trail historical average of 3% through 1990. Page 9

Mobay may enter wastewater treatment business using new system developed by West German parent company, Bayer A.G. Page 11

Government

Individual possession, distribution of biological weapons made illegal in recent Senate bill. Page 13

Congressional budget compromise gives R&D slight reprieve, sequester order still will have deleterious effects on research funding. Page 14

Science/Technology

Flue gas desulfurization system to undergo first full-scale U.S. trials at northern Indiana plant. Page 17

New European environment agency will provide member countries with the information necessary to safeguard the environment. Page 18

Caltech launches Linus Pauling lecture series with Pauling himself giving the first annual lecture. Page 18

Two-week research visits to Eastern Europe for American scientists are new category added to NAS's exchange programs. Page 19

Cover: Photo by Kent Knudson/
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Letters	2
Concentrates	
Business	7
Government	12
Science/Technology	16
The Departments	
Books	47
ACS Comment	49
ACS News	51
Newsclips	64

World Chemical Outlook

Growth in demand for chemicals has slowed markedly in the past few months and is now overbalanced by supply. As a result, prices have slumped and producers' profit margins are being squeezed, with the screws likely to tighten even more in 1990. Page 22



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LETTERS

CHEMICAL SAFETY

Chlorosulfonic acid and heptane

SIR: Mixing chlorosulfonic acid and alkanes can result in a hazardous situation. Tennessee Eastman Co. experienced the rupture of a weigh tank when heptane was pumped into a tank containing chlorosulfonic acid in an effort to clean the lines and the tank.

The unexpected reaction between heptane and chlorosulfonic acid resulted in the formation of large volumes of gas that ruptured the weigh tank. Experimentation revealed that without agitation, the reaction proceeded slowly (two phases present). Laboratory experimentation also demonstrated that large volumes of gas, primarily hydrogen chloride, were rapidly formed when chlorosulfonic acid and commercial heptane (heptane isomers) were agitated.

A literature search revealed that hydrogen chloride [Jackson, K. E., *Chem. Rev.*, **25**, 67 (1939)] and sulfur dioxide [Gordon, G. S., Burwell, R. L., *J. Am. Chem. Soc.*, **71**, 2355 (1949)] were the reported major gaseous products resulting from the reaction of alkanes and chlorosulfonic acid. An informal poll of co-workers revealed that the reaction of chlorosulfonic acid with alkanes was not common knowledge.

However, the reaction of alkanes with chlorosulfonic acid is briefly mentioned in the third edition of Kirk-Othmer's *Encyclopedia of Chemical Technology*. Thus, it seems appropriate to share this information with your readers to help prevent the recurrence of this or a similar incident.

John D. Baker

Senior Chemist, Organic Chemicals Division
Development & Control Department
Tennessee Eastman Co., Kingsport, Tenn.

Safety of rubber additives

SIR: A letter by Jerry McLaughlin and Jee Jung (C&EN, July 10, page 3) drew attention to two reports regarding mercaptobenzothiazole (MBT) and raised issues related to human health and safety. MBT is a benzothiazole accelerator used in rubber production and can be found in trace amounts in many rubber-containing products.

The letter cited one study that examined the potential of MBT to cause cancer in laboratory animals [Dieter, M. P., "Toxicology and Carcinogenesis Studies of 2-Mercaptobenzothiazole in F344/N Rats and B6C3F1 Mice," NTP TR 332, NIH Publication No. 88-2588 (May

1988)]. The letter (not the National Toxicology Program report) drew the conclusion that MBT "should not be included in consumer products."

The National Toxicology Program report showed the following:

- Tumors were found in MBT-treated rodents, but the same spontaneous tumor types were found in the untreated, control animals.

- Increased incidence of certain tumors was found in animals of the low dose group but not at the high dose.

- Many of the increased frequencies fell within the range of background incidences of these normally occurring tumor types.

- No consistent trend was found for reductions of time to first tumor incidence.

- No consistent trend was found for progressions from benign to malignant tumor types.

- The study involved lifetime exposures to very high doses, as intended in these worst-case toxicology studies, resulting in reduction in survival, with no clear evidence of carcinogenicity.

When the first three findings occur together in a single study, they greatly weaken the case for carcinogenic potential. The next two findings show a lack of common neoplastic determinants that exist for most established carcinogens, the absence of which casts doubt on the carcinogenic potential of a chemical. The last finding identifies a basic fault in design of the study inasmuch as it indicates that a maximum tolerated dose was exceeded. With this basic fault in design, scientific inference as to the carcinogenic potential of MBT is inappropriate. Although the National Toxicology Program report concluded that there was some, but not clear, evidence of carcinogenic activity, the cumulative weight of evidence outlined above indicates that carcinogenic potential was at best marginal. The National Toxicology Program does not consider the evidence sufficient to include MBT in its annual report on carcinogens, which currently lists over 140 chemicals. For these reasons, any suggestion that MBT should not be included in consumer products on the basis of carcinogenic risk is unfounded. If a compound is found to have some carcinogenic activity, decisions on safety are made on the basis of a more comprehensive risk assessment. In the absence of clear evidence of carcinogenicity, it is inappropriate to propose that a chemical should not be included in a consumer product.

Another conclusion that the letter made regarding the potential for allergy from MBT exposure is far from convincing. The reference cited is a single case

U.S. Polystyrene Demand Growth Holding Below Average

Polystyrene demand growth will continue at 2 to 2.5%, below historical rate, putting pressure on selling prices of most grades through 1990

Bruce F. Greek, C&EN Houston

Current growth in demand for polystyrene—2 to 2.5% per year—in the U.S. is expected throughout next year to remain below the historical average of 3%. The slowing in demand plus new capacity expansions will keep pressure on selling prices for most grades of polystyrene through next year.

Interpolymer competition in packaging has contributed to the slowdown in consumption of polystyrene. Competition from other packaging materials such as paper and paperboard also could cut into the plastic's growth. And another fac-

tor could be environmental concerns both about the gases released in the manufacture of polystyrene foam forms and about packaging disposal, especially of fast-food containers. Although recycling is still small, it too could significantly reduce demand for polystyrene in the future.

This year U.S. production of polystyrene likely will total 5.3 billion to 5.4 billion lb, up about 2.5% from 1988. This year's expected increase will be about a third of that in 1988, which was up about 8.5% over the previous year. In 1987 and 1988, production growth in polystyrene was double to triple historical growth, raising the decade average. This year and next, lower growth again will bring the average down to about 3%.

World demand for polystyrene will grow an average of 4.6% annually between 1987 and 1993, according to a study completed by DeWitt & Co., Houston. The study reports that world demand increased 6.7% in 1988 to 16.4 billion lb. Global growth last year was below that in the U.S., but it is not expected to slip as much this year and next year as compared with the U.S.'s decline.

By 1993, world demand for polystyrene will total 20 billion lb, according to DeWitt vice president William C. Kuhlke who directed the study. About 85% of the demand will occur in three regions—North America, Western Europe, and the Asia/Pacific area.

World capacity to make polystyrene will grow 4.8% annually between 1987 and 1993, slightly faster than will production, says Kuhlke. By 1993, it will amount to about 22.6 billion lb. Plant operating rates are forecast to decrease modestly until 1991 and then begin a slow rise through 1993.

U.S. polystyrene capacity has been

Polystyrene at a glance

Production: Estimated 1989 U.S. total 5.3 billion lb, up 2.5% from 1988

Capacity: Nameplate at year's end 6.2 billion lb; to increase 10% in 1990

How made: Mass or solution polymerization (polybutadiene dissolved in styrene for impact or rubber-modified grades) and suspension polymerization (mainly for expandable bead forms)

Major U.S. producers: Amoco Chemical, Arco Chemical, Chevron Chemical, Dow Chemical, Fina Oil & Chemical, Huntsman Chemical, Mobil Chemical, Polysar

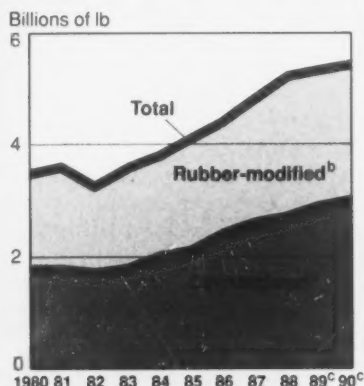
Price: List 50 cents per lb for crystalline grades to 80 cents per lb for high-impact modified grades

Commercial value: \$3 billion for estimated 1989 production

rising at a rapid rate this year and is forecast to increase about 10% next year. With completion of some small expansions during this quarter, capacity will reach 6.2 billion lb. The capacity expansions of this year and next are all at existing production sites. No new polymer plants likely will be built in the U.S. until after the early 1990s. This contrasts with the more rapid capacity increases in other parts of the world especially the Asia/Pacific area where a major part of the expansions are at new sites.

U.S. capacity operated this year averaged about 6.1 billion lb. Production through August totaled 3.54 billion lb, according to the Committee on Resin Statistics of the Society of the Plastics Industry as compiled by Ernst & Young. Assuming

U.S. polystyrene production growth slowing



^a Includes crystal, general purpose, and foamed (expandable beads) forms. ^b Impact forms. ^c Estimates. Sources: Committee on Resin Statistics of the Society of the Plastics Industry as compiled by Ernst & Young; C&EN estimates

World polystyrene demand to hit 20 billion lb in 1993

Region	Billions of lb
Asia/Pacific	6.0
North America	5.0
Western Europe	5.0
Eastern Europe	1.8
Africa/Middle East	0.6
Latin America	0.6
TOTAL	20.0

Source: DeWitt & Co.

that output was not reduced appreciably as prices declined this fall, production for all of 1989 may total 5.3 billion lb. Based on these estimates of production and capacity, the average operating rate will slip to about 87% of nameplate capacity, down from about 90% during 1988. Capacity utilization will further drop in 1990 to about 80% of nameplate capacity, unless some capacity is shut down.

Industry sources speculate that some of the smaller and older units of both large and small producers could be shut down during 1990. The older polystyrene plants are inefficient and may lack the refinements to make specialty grades that sell for higher prices. The amount of capacity that will be shut down likely will be small, probably 300 million lb or less. Capacity utilization may then move up less than 3% for the year.

Pressure on selling prices of polystyrene has increased during the fourth quarter, following earlier pressure on those of polyolefins and polyvinyl chloride. By the end of November, selling prices for general purpose crystalline grades had dropped to below 50 cents per lb, down from about 60 cents per lb early in 1989. The effect on other grades of polystyrene has varied, ranging from declines almost as large to negligible ones.

Styrene prices also have been dropping, while benzene prices have increased on both contract and spot markets. Operating problems and maintenance shutdowns at several benzene units (both reformers and toluene dealkylation units) limited benzene production temporarily, according to industry sources.

In early 1990, benzene production is expected to recover and prices are likely to drop, particularly on the spot market.

At prices of slightly below 50 cents per lb, polystyrene costs more than polyolefins suitable for similar uses. Polypropylene especially has been taking markets from polystyrene. Large capacity expansions to make polypropylene and rapidly falling monomer costs have triggered the decline in polypropylene's selling prices. The drop in polyolefin selling prices has slowed significantly since the loss of a large part of the U.S. capacity to make high-density polyethylene resulting from the explosion and fire at the Phillips 66 plant in Pasadena, Tex. However, polystyrene prices still are higher than polypropylene prices.

Most of the interpolymer competition for polystyrene occurs in packaging, which accounts for about a third of consumption. Polystyrene for packaging is fabricated by both extrusion and molding. Currently, the major competition occurs in the nonfoamed sheet products—cups, containers for dairy products, and lids (including bottle caps). A significant share of these products use impact-grade polystyrene, which costs more than the general purpose grades. Because of the competition, the nonfoamed uses are forecast to grow more slowly than total polystyrene consumption. Consumption of this form for packaging likely will decline this year and may continue during 1990.

The other major packaging uses require foamed forms, initially fabricated as foamed sheet and expandable beads. These packaging uses account for more than 10% of total consumption and also are expected to grow more slowly than total use. The major consumer products of foamed sheet polystyrene are trays for meat and produce, egg cartons, and containers for various kinds of other processed food. Because many of these containers are consumer items, environmental concerns could affect their use more quickly than other packaging products and could limit growth. Antiplastics sentiment likely will have more effect than interpolymer competition, leading to substitution by paper packaging

and dampening growth for these uses of polystyrene.

Building and construction, at about 10% of the total, is a relatively distant second in the markets for polystyrene. More than 80% of construction use is in insulation board, made either of foamed polystyrene or expandable beads and often laminated with other materials. Although the variations in volume of construction affect demand, the average growth for this use is forecast to be greater than for all uses of polystyrene.

Appliances and consumer products, slightly smaller than the construction market, also account for about 10% of polystyrene consumption. The appliances market (largely cabinets for various electronic items and parts for refrigerators) has been spotty for polystyrene, depending on changes in styles and on new components as well as on competition from polypropylene.

Polystyrene also has been seeing increased competition for consumer products made from polypropylene; such products are price-sensitive in many of their markets. Redesign of some appliance components may allow polystyrene to replace acrylonitrile-butadiene-styrene, which would offset some of the demand lost to polypropylene. If polystyrene prices decline further, making it more competitive, these uses will continue to increase faster than average.

Other applications and exports likely will grow at about 2.5% next year. Some specialized uses, such as medical and laboratory devices, may grow above average, but will be offset by other slower growing uses, which include such products as small items for office use, various kinds of knobs and handles, and louvers and other parts for lighting fixtures. Use of polystyrene in several types of plastic alloys and blends with various other polymers has slowed but could increase as new products are developed.

Exports of polystyrene likely will exceed imports by more than 275 million lb this year, far above the less than 150 million lb of 1988. But such a level is unlikely to hold because of added capacity being built in other parts of the world. □

World Chemical Outlook

After two or three years of extraordinarily favorable conditions for producers of chemicals, the business climate this year has become markedly different.

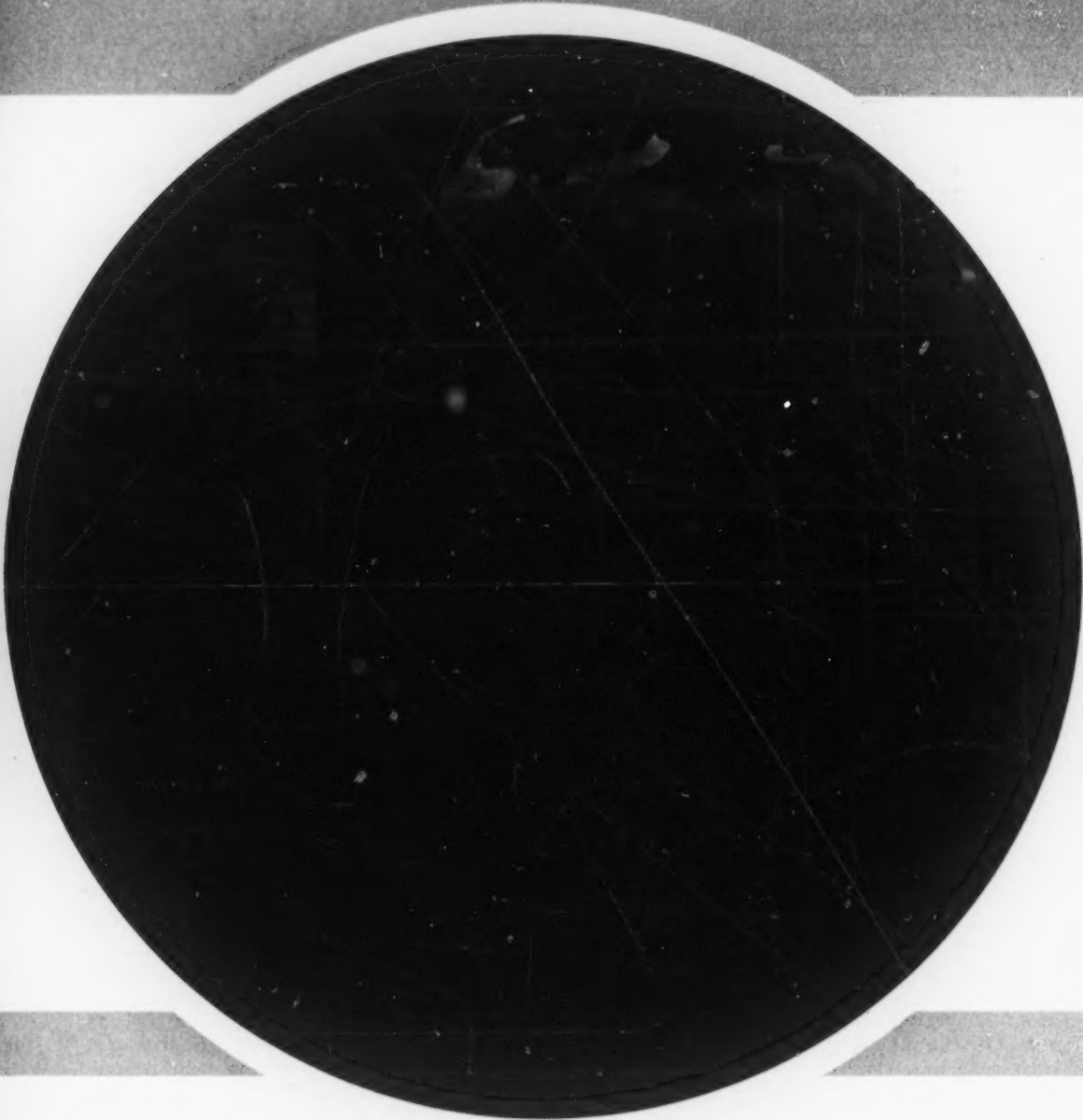
At the start of 1989, the economies of the industrialized western world were all strong. Customers' appetite for chemicals and the products made from them seemed insatiable. Chemical firms were running their plants full out and still not meeting market demand. They

were in the enviable position of being able to mark up prices with ease, even though feedstock costs were relatively low. Not surprisingly, therefore, profitability in the chemical industry was surging.

Now, as 1990 makes its entrance, economic growth seems to be easing. At the same time, plant capacity has been building up. Consequently, supply of many petrochemicals, as well as plastics and other derivatives, has overtaken

demand. Competition in the global marketplace has become more cutthroat once again.

In the U.S., many chemical companies, especially those whose business is focused on commodity products, have been forced to cut prices drastically in recent months to maintain market share. Profits, not surprisingly, have weakened significantly. Although export business remains brisk, the word from Western Europe, Japan, and Canada is much the same.



Business still looks sound for much of the chemical industry, to be sure, such as specialty chemicals or pharmaceuticals and other consumer items. And economic forecasts generally look for continued expansion during the year ahead, although at a slower pace than recently. So hardly anyone in the industry really expects the early 1990s to reprise the early 1980s. But to avoid that, industry executives will be facing some tough decisions during the year ahead.

United States 24

Foreign Trade 29

Western Europe 34

Japan 38

Canada 41

**U.S.S.R./
Eastern Europe.....43**

China 46

United States



Prices are sinking and a shift from a seller's to a buyer's market is putting the profits of U.S. chemical makers in jeopardy

David M. Kiefer
C&EN Washington

Déjà vu, all over again, for the U.S. chemical industry? The evidence is by no means yet clearcut. But demand has been slack during the past six months for many big-volume petrochemicals and their derivatives. At the same time, production capacity has been building up rapidly. Not surprisingly, selling prices have tumbled. All of which has an unnerving resemblance to business conditions seven or eight years ago, when the chemical industry was sorely pressed by too much output chasing too few customers.

Selling prices for industrial chemicals have slumped 5 to 6% since they peaked last May, government figures indicate, and now are about 1% lower than they were a year ago. For plastics, current prices are even more depressed—down more than 10% since hitting a high early last spring.

Are the economic developments of this year's second half indeed a harbinger of an impending cyclical downturn for the chemical industry, similar to the one that wracked it in the early 1980s? Already, industry earnings are again clearly under pressure. For producers of basic chemicals as a whole, profits were down about 15%, compared with 1988, during this year's third quar-

Competition heats up as demand for chemicals cools

ter. Comparison between the current three months and last year's like period is likely to be even less favorable.

But the shape of 1989's chemical industry differs significantly from that of 1981 and 1982. For one thing, after the sweeping restructuring and retrenching undertaken by many chemical producers following the last recession, the industry's cast of characters now has changed considerably.

Many of the companies that dominated the industry a decade ago—such as Du Pont, Dow Chemical, and Monsanto—still do so. But not in the same way. They are much more diversified now, much less dependent on commodity chemicals and plastics products for sales and earnings. Pharmaceuticals and other consumer items, as well as specialty materials like pesticides, play a much bigger role. The goal was enhanced growth, higher return on investment, and greater earnings stability.

The strategy may be working. Look at Monsanto, for example. It has undergone perhaps the most dramatic shift in product focus of any of the leading chemical firms; it managed to lift this year's third-quarter net income 9% from a year earlier, with a big part of the gain a function of improved results from pharmaceuticals, its Nutrasweet artificial sweetener, and industrial controls. Widely diversified Du Pont likewise chalked up higher third-quarter earnings this year. And although Dow's earnings were off 7% from a year ago, they would have looked a lot worse were it not for strong results from its expanding consumer specialties operations.

Likewise, many of the smaller old-line chemical companies, those

whose business is focused on specialty products, continue to fare remarkably well. Third-quarter earnings for companies like Crompton & Knowles (up 47% from the year before), Loctite (up 21%), Nalco Chemical (up 21%), and Great Lakes Chemical (up 18%), all suggest continued strength for products sold into narrowly targeted end-use markets. The financial performance of some of these companies, of course, at the same time is benefiting from recent markdowns in the prices of many of the petrochemical intermediates they buy.

On the other hand, companies that are tied still to commodity chemicals—many of them relative newcomers to the industry that picked up plants for making petrochemicals and polymers when they were shucked off by several of the leading chemical and petroleum operators during the mid-1980s—are the ones who are bearing the brunt of recent oversupply and price weakness.

Thus, third-quarter profits for Aristech Chemical nosedived 47% from the year-earlier period, primarily because of price erosion and an unsettled export market for polypropylene. Turmoil in the polypropylene market also is largely responsible for the 71% slump in Himont's third-period earnings.

B. F. Goodrich's net from continuing operations fell 43%; company chairman John D. Ong explains that for polyvinyl chloride "industry capacity has overtaken demand," prices have dropped, and that some time may be required to bring supply and demand back into balance. Quantum Chemical's profits plummeted 79% (before factoring in the cost of two plant fires and a special accounting charge), reflecting lower sales and narrowing profit mar-

gins in its polyethylene operations. And shrinking profit margins for styrene and polystyrene operations cut into Huntsman Chemical's earnings.

Clearly, producers of petrochemicals and plastics no longer are harvesting the bountiful profits of the past two or three years. And a glut in capacity for producing olefins and their derivatives is a definite threat that will be hanging over the industry not only next year but throughout the early 1990s.

Whether the downturn in earnings for petrochemical and plastics producers worsens and spreads more widely throughout the overall chemical industry hinges largely on the health of all the nation's business. And lately, the national economy has been wheezing.

During the 12 months through this past September, real gross national product has grown nearly 3%, with the three months ending with September alone registering an annual rate of growth of 2.7%. That's a better showing than most economists had forecast would be the case 12 months ago. Nevertheless, signs of increasing turbulence in the current business climate are becoming more plentiful. Industrial production has been relatively flat since last spring. Growth in consumer spending is slowing. And fewer new jobs are opening up now than a year ago.

Economists generally expect 1989's final three months will show distinctly slower growth in GNP, with the quarter-to-quarter increase perhaps dwindling to an annual rate of close to 1%. That would mean that expansion of GNP for all of 1989 will be nearly 3%, compared with nearly 4.5% the year before.

The consensus of economic opinion now is that GNP will continue to edge higher again in 1990, probably at an annual rate no greater than 1.5 to 2.5%. But the majority of business economists are still betting on the much-heralded "soft landing" for the U.S. economy. They also seem firmly convinced that the U.S. will work its way through another year without experiencing an actual downturn in the business cycle.

It also is widely conceded, however, that whatever further growth in GNP occurs next year will be

largely driven by the service industries, rather than manufacturing. And that is not a particularly cheerful prospect for chemical producers, whose customers are located throughout all U.S. manufacturing activity. Moreover, some of their best customers, such as the automobile industry and home builders, are the ones who now seem most at risk.

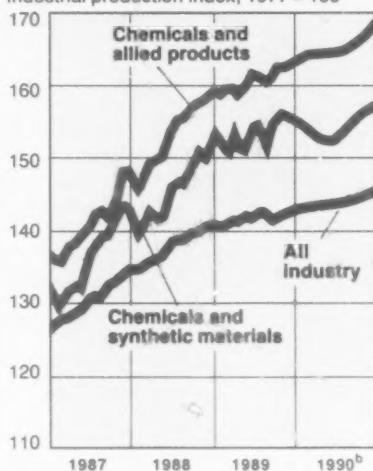
The number of new housing units started has been falling month by month during nearly all of 1989, sinking to the lowest level for any

month in about seven years last September. For the whole year, housing starts probably will total nearly 1.4 million, down 6% from last year. Lower interest rates on mortgages are likely to encourage home buyers, but high prices on new homes are a strong offset. Although home builders are hopeful that the decline in the housing market may now be bottoming out, they do not really expect housing starts to increase appreciably next year.

Automobile producers seem to be

Growth is slowing for U.S. chemical production...

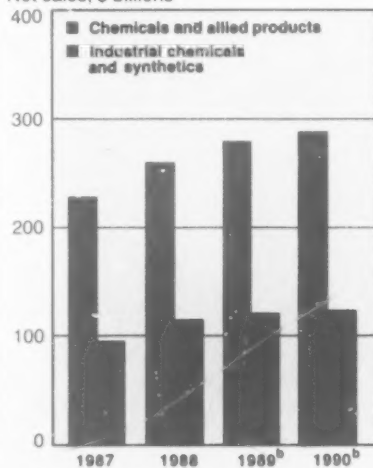
Industrial production index, 1977 = 100^a



^a Seasonally adjusted. ^b C&EN estimates. Source: Federal Reserve Board

...and as sales volume expands weakly...

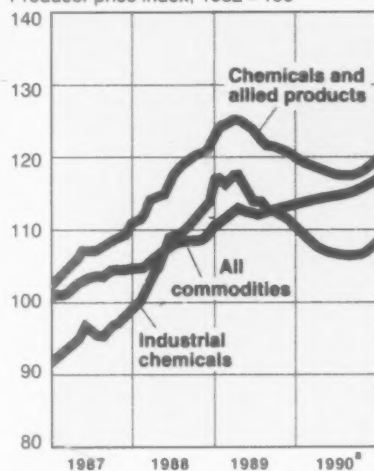
Net sales, \$ billions^a



^a Excludes sales of foreign affiliates. ^b C&EN estimates. Source: Bureau of the Census

...while selling prices are softening markedly...

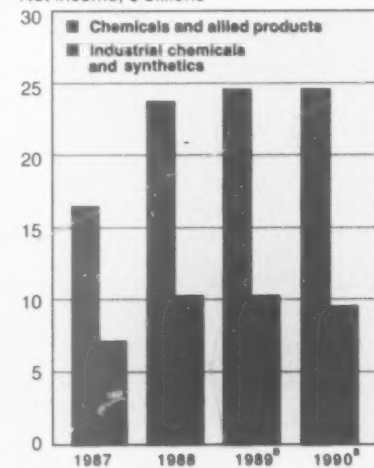
Producer price index, 1982 = 100



^a C&EN estimates. Source: Bureau of Labor Statistics

...the outlook for chemical firms' earnings is dimmer

Net income, \$ billions



^a C&EN estimates. Source: Bureau of the Census

having an even tougher time persuading consumers to buy their new models. Car sales slumped drastically this past October and November from the year before. Consequently, car makers have cut back production to the lowest level since late 1972, laying off workers and shutting down assembly lines. This year, production is likely to drop below 7 million cars, down 3% from last year. Truck production, which has generally held up better than car output, also will not quite match last year. The auto industry is girding for slower sales again in 1990, perhaps down 5% or more from this year's level of nearly 15 million cars and trucks. That portends an even greater falloff in U.S. production.

Other industries also are likely to provide less buoyant markets for chemical products. Shipments of major home appliances are little changed this year from 1988, and probably will drop 2 to 4% next year, for example. And production of paper and paperboard is rising more slowly and will increase only about 1% this year, compared with a 3% gain in 1988.

Assuming the U.S. economy does indeed achieve a soft landing next

year, C&EN estimates that production of basic chemicals and synthetic materials, ahead nearly 6% this year, will be essentially unchanged in 1990, give or take a percentage point. Prices of industrial chemicals, meanwhile, probably will continue to fall, at least during the early months of the year. For all of 1990, they are likely to be down about 6% on average, on the heels of a 7 to 8% increase this year that reflects rapid increases last winter and spring.

This is a scenario that spells trouble for basic chemical producers' earnings statements. This year, a relatively strong first half is being balanced by decidedly poor results in the final six months. The year as a whole, therefore, will be pretty much a standoff, with net income for the industry overall about unchanged from 1988. For many companies whose basic chemicals business has not been cushioned by diversification into consumer or specialty chemical lines, moreover, profits will be below those of last year. Next year, C&EN forecasts profits for basic chemical companies will decline, perhaps 7 to 12%.

For other segments of the broad

chemical business, however, the outlook is largely still upbeat, barring an outright recession. Specialty chemical firms will have a solidly profitable year in 1989 and probably will ring up at least moderate further gains in 1990. Pharmaceutical companies, too, are still on a roll, thanks to a steady stream of hot-selling and high-margined new products that they have been introducing during the past few years. Fertilizer makers, who were plagued by severe price erosion this year, also are more optimistic about the year ahead, in light of prospects for rising crop plantings and high farm income.

Even the relatively bleak prospects for producers of basic chemicals should be viewed in perspective. For them, the past couple of years have been exceptionally good—a hard act indeed to follow. Unless the recent downtrend accelerates, which few in the industry now expect, their selling prices next year will still average comfortably above those of two or three years ago. And profits in 1990 are likely to be eclipsed only by those for this year and last—and will be nearly double those of just three years ago. □

Output edges lower for many of the chemical industry's big-volume products

	1987	1988	1989	1990
INORGANIC CHEMICALS				
Thousands of tons unless otherwise indicated				
Ammonia	16,095	16,937	17,100	17,400
Chlorine gas	11,019	11,330	11,100	10,700
Hydrochloric acid	2,869	2,834	2,750	2,500
Nitric acid	7,225	7,887	7,950	7,900
Oxygen, billions of cu ft	403	449	460	450
Phosphoric acid	10,685	11,729	11,700	11,900
Sodium hydroxide	11,486	11,985	11,900	11,600
Sulfuric acid	39,235	42,775	43,700	44,000
ORGANIC CHEMICALS				
Millions of lb unless otherwise indicated				
Acetic acid	3,246	3,159	3,400	3,200
Acetone	1,846	2,303	2,350	2,300
Acrylonitrile	2,452	2,609	2,850	2,800
Benzene,* millions of gal	1,576	1,588	1,600	1,550
Butadiene	2,931	3,169	3,100	3,100
Caprolactam	1,156	1,261	1,250	1,200
Cumene	4,105	4,455	4,400	4,250
Cyclohexane	2,276	2,297	2,300	2,150
Ethylene	34,951	37,204	35,500	35,000
Ethylene glycol	5,183	5,317	5,600	5,300

	1987	1988	1989	1990
Formaldehyde				
	5,733	6,280	6,200	6,000
Methanol				
	7,537	8,142	7,900	7,500
Phenol				
	3,351	3,562	3,500	3,500
Phthalic anhydride				
	1,035	999	1,020	980
Propylene				
	19,019	21,224	21,000	19,800
Styrene				
	8,014	8,984	8,300	8,100
o-Xylene				
	940	971	850	780
p-Xylene				
	5,155	5,601	5,700	5,600
PLASTICS				
Millions of lb				
Polyethylene, high density				
	7,995	8,399	8,050	7,800
Polyethylene, low density				
	9,599	10,398	9,300	8,900
Polypropylene				
	6,647	7,272	7,350	7,300
Polystyrene				
	4,780	5,130	5,100	4,900
Polyvinyl chloride				
	7,971	8,350	8,450	8,500
SYNTHETIC FIBERS				
Millions of lb				
Acrylic and modacrylic				
	592	588	550	530
Nylon				
	2,690	2,669	2,700	2,600
Olefin and vinyon				
	1,494	1,568	1,650	1,680
Polyester				
	3,540	3,680	3,650	3,550

* Petroleum refiners only. Sources: Bureau of the Census, International Trade Commission, Society of the Plastics Industry's Committee on Resin Statistics, Fiber Economics Bureau, C&EN estimates (for 1989 and 1990)

Foreign Trade



With exports of chemicals rising twice as fast as imports, trade surplus hits record \$16 billion

Earl V. Anderson
C&EN Northeast News Bureau

If all U.S. trade were like its chemical trade, the Administration and Congress wouldn't have to struggle with a lingering and burdensome balance of trade deficit. That overall trade deficit—happily—will decline again this year, if only slightly. But at an estimated \$110 billion, it is still uncomfortably high.

The U.S. chemical balance of trade, meanwhile, is very much in the black. In fact, it will soar to a new record surplus of \$16.4 billion this year.

The U.S. chemical industry's trade performance is nothing short of a marvel. World trade in chemicals, measured as exports, likely will increase only 6% in 1989, following two successive years of gains of 20% plus. But chemical exports from the U.S. probably will be up a hefty 17% to \$37.7 billion, higher than ever before. That performance will propel the U.S. share of world chemical exports up 1.4% to 14.8%.

U.S. chemical imports will also increase—to a record \$21.3 billion. But that will be only a 7% gain, which is pretty much in line with the overall growth of worldwide chemical trade.

Export markets remain strong for U.S. chemicals

Stronger growth in exports than in imports is also reflected in the overall U.S. trade picture. For the third successive year, U.S. export growth will outpace that of imports. Exports are likely to advance 13% to \$365 billion, while imports will be up only 8% to \$475 billion.

This lopsided growth will be enough to pare the trade deficit from \$119 billion in 1988 down to \$110 billion this year, the lowest it has been since 1984. But it's still too high to satisfy many international economists, who believe that the U.S. trade deficit, coupled with its budget deficit, ranks alongside developing countries' massive debt as one of the world's major economic problems.

The fact that U.S. exports, including chemical exports, are outpacing imports this year is something of a paradox, as far as currency exchange rates are concerned. A strong dollar hurts exports by making them more

expensive and therefore less competitive in foreign markets. It also makes imports less expensive and better able to compete in the U.S. against domestic products.

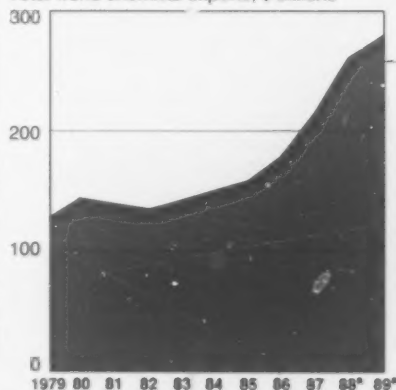
A weaker dollar does just the opposite. It helps exports and hurts imports. That is why, after the dollar started falling from its record peak in 1985, the U.S. trade deficit started falling, from its high of \$153 billion in 1986.

This year, however, the dollar has recovered some of its lost strength. By midyear, it was up more than 20% against the Japanese yen and British pound and 16% against the West German deutsche mark.

Since June, the dollar has weakened somewhat against the major foreign currencies, but it is still higher against most of them than at the end of 1988. At the end of November, for instance, the dollar stood at 143 yen, up 16% for the year. It was also up 17% against the

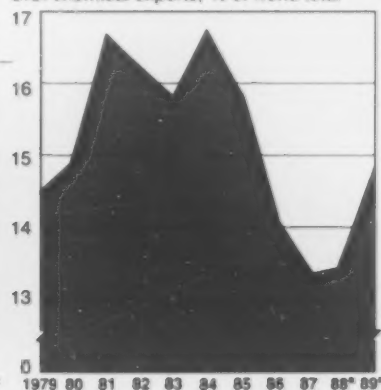
Growth in global chemical exports moderates...

Total world chemical exports, \$ billions



...while U.S. share of total improves a bit

U.S. chemical exports, % of world total^b



^a C&EN estimates. ^b Defined as U.S. chemical exports as percentage of world chemical exports less U.S. chemical imports. Sources: United Nations, Organization of Economic Cooperation & Development, European Community, Japanese Ministry of International Trade & Industry

Organic chemicals and plastics lead another surge in U.S. chemical exports

In Millions	U.S. chemical exports				U.S. chemical imports			
	1988 ^a	1988	1987	1986	1988 ^a	1988	1987	1986
Organic chemicals	\$11,220	\$ 9,381	\$ 7,550	\$ 6,293	\$ 7,457	\$ 6,953	\$ 5,408	\$ 4,704
Plastics and resins	8,155	7,277	5,492	4,301	3,417	2,433	1,987	1,837
Medicinals and pharmaceuticals	3,663	3,941	3,182	3,090	2,134	1,859	1,456	1,240
Fertilizers, manufactured	3,008	2,498	2,259	1,935	1,060	1,021	795	865
Inorganic chemicals	3,001	2,702	2,122	1,771	2,318	2,498	2,030	1,894
Radioactive materials	1,611	868	1,017	1,302	786	1,098	1,012	1,382
Pesticides and disinfectants	1,163	910	732	664	217	577	398	580
Flavors, perfumes, cosmetics, and toiletries	1,024	709	579	488	978	932	796	679
Pigments, paints, and varnishes	663	449	411	333	527	395	427	348
Cleaning and polishing materials	407	395	357	302	206	260	205	214
Dyeing, tanning, and coloring materials	312	258	217	174	595	610	621	487
Explosives and pyrotechnics	117	91	91	81	128	118	110	111
Miscellaneous	3,306	2,611	2,382	2,032	1,427	1,122	968	660
TOTAL	\$37,650	\$32,300	\$28,381	\$22,766	\$21,250	\$19,876	\$16,213	\$15,001

^a C&EN estimates. Source: Bureau of the Census

British pound at 0.64 pound per dollar and up 2% against the mark at 1.79 marks per dollar.

Theoretically, this trend in dollar exchange rates should have hurt U.S. exports and given a boost to imports. But theory doesn't always hold true in world trade. Exactly the opposite is happening this year.

One reason is the time lag, or J-curve, as economists refer to it. Exports and imports don't respond immediately to changes in currency exchange rates. It may take many months—even years—for changes in exchange rates to have an impact on trade.

Jeffrey A. Rosensweig, professor of international business and finance at Emory University's business school in Atlanta, Ga., says that this year's rise in the dollar is too recent, too moderate, and perhaps too temporary to disrupt the trend toward slowly improving U.S. trade balances. He believes that this year's U.S. trade patterns are still responding to the fairly low dollar values of 1988.

U.S. exports also may be rising faster than imports because the U.S. economy is cooling off. A weaker economy tends to create less demand for imports, while still-strong economies overseas are acting as a magnet for U.S. exports.

As usual, economists disagree about what will happen to the U.S. trade balance next year. Some say that the trade balance will deteriorate

rate in 1990. Others believe that it will improve, perhaps dropping to below \$100 billion. That's a level it has not seen since 1983.

If a weaker dollar does, in fact, help at all, then the dollar is heading in the right direction. Many currency traders believe that the dollar's recent decline will continue into next year. One reason is that they expect interest rates in the U.S. to move lower as the Federal Reserve Board tries to keep the economy from sliding into recession.

Another is that some interest rates abroad are expected to rise, particularly in West Germany and Japan. Falling interest rates tend to weaken a currency, whereas rising rates tend to strengthen it.

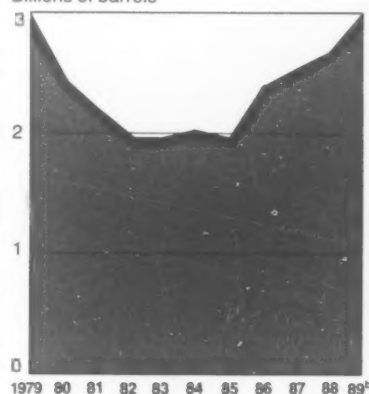
On the other hand, if falling interest rates stimulate the U.S. economy too much, they could trigger a stronger demand for imports. And higher interest rates overseas could dampen economic growth enough to put a crimp in demand for U.S. exports. Neither of these developments would bode well for the U.S. trade balance.

U.S. trade fortunes in the coming year, then, will depend heavily upon how adept the world's finance ministers are at balancing interest rates, exchange rates, and economic growth rates. And that's something that's virtually impossible to predict.

Whether the trade balance improves or worsens next year, most

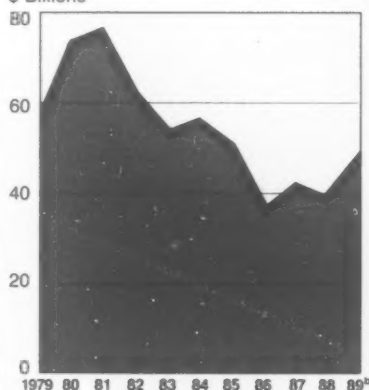
Rise in volume of U.S. oil imports...

Billions of barrels^a



...plus higher prices up U.S. import bill

\$ Billions^a



^a All petroleum products. ^b C&EN estimates. Source: Bureau of the Census

Total U.S. exports bolstered by growth for chemicals and other manufactured goods

\$ Billions	U.S. exports				U.S. imports			
	1989 ^a	1988	1987	1986	1989 ^a	1988	1987	1986
Chemicals	\$ 37.7	\$ 32.3	\$ 26.4	\$ 22.8	\$ 21.3	\$ 19.9	\$ 16.2	\$ 15.0
Machinery and transportation equipment	147.6	135.1	108.6	95.3	206.4	197.0	177.8	161.6
Other manufactured goods	59.8	47.3	36.5	30.6	138.9	131.9	118.6	105.5
Crude materials (inedible) other than fuels	27.2	25.1	20.4	17.3	15.9	13.4	11.5	10.4
Mineral fuels, lubricants, and related materials	9.4	8.2	7.7	8.1	52.6	41.1	44.2	37.3
Food and live animals	30.3	26.4	19.2	17.3	21.4	20.1	20.5	20.8
Beverages and tobacco	5.2	4.5	3.7	2.9	4.1	4.1	4.1	3.9
Animal and vegetable oils and fats	1.4	1.5	1.0	1.0	0.8	0.8	0.6	0.5
All other products	32.4	27.5	20.4	11.0	13.6	12.6	12.4	14.9
TOTAL	\$365.0^b	\$322.4^b	\$252.9^b	\$217.3^b	\$475.0	\$440.9	\$405.9	\$370.0

^a C&EN estimates. ^b Includes reexported imports (not included in individual product categories). Source: Bureau of the Census

economists agree that the movement will be small. They also agree that the U.S. trade balance would be significantly better were it not for the much higher bill that the U.S. is paying for imported oil.

This year, U.S. importers will shell out about \$48 billion for foreign petroleum and petroleum products. That's 25% higher than last year, even though the volume of oil imported will rise only 9%. The reason, of course, is that the average unit price of imported oil will top \$16 per barrel this year, while it was just slightly over \$14 per bbl in 1988.

Little letup is in sight for this higher level of oil imports. According to the American Petroleum Institute, imports of crude oil and petroleum products in October averaged 8.2 million bbl per day, com-

pared with 7.8 million in October 1988. This is despite the fact that oil consumption in the U.S. is declining.

What is also declining, however, is domestic crude production. As a result, imports now account for almost half of U.S. consumption. Not surprisingly, some energy experts fear that the stage is being set for another oil crunch in the U.S.

The U.S. chemical industry has no such trade problems. It established a new record surplus in its trade balance last year. It will easily top that record this year. And, in all likelihood, the industry will set still another record trade surplus in 1990.

Estimating next year's chemical trade performance is little more than a guessing game. But most guesses are centering on a 6 to 8% improvement in both chemical exports and

chemical imports. If this is correct, U.S. chemical exports will come close to or exceed \$40 billion for the first time. The chemical trade surplus, which likely will hit \$16.4 billion this year, probably will top \$17 billion and could surpass \$18 billion in 1990.

To rise this way, U.S. chemical companies must continue getting strong performances from their export heavyweights—organic chemicals, plastics, pharmaceuticals, and fertilizer. Together, these four categories account for almost 70% of U.S. chemical exports.

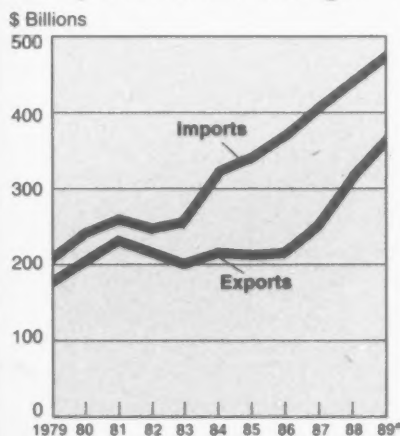
Organic chemicals and fertilizer are both having strong years on export markets in 1989. Both will end the year with a gain of about 20%. Pharmaceuticals and plastics, however, are a different story.

Pharmaceutical exports will decline this year. Plastics exports are increasing, but are likely to gain only 12% over 1988 to \$8.2 billion. That wouldn't be bad were it not for the fact that plastics imports probably will increase 40% to \$3.4 billion.

This surge in plastics imports means that the huge trade surplus in plastics will actually decline from \$4.8 billion to \$4.7 billion. This will result in the first drop in the plastics trade surplus since 1985.

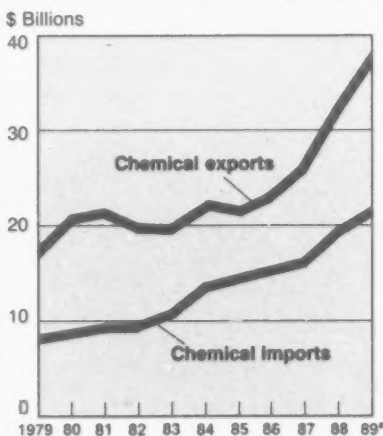
Plastics trade statistics, however, may be misleading. The government has changed its reporting system since the first of the year, when the U.S. converted to the harmonized tariff system. As a result, statistics on plastics exports and imports for 1988 and 1989 may not be directly comparable. □

U.S. trade picture brightens as exports remain strong ...



^a C&EN estimates. Source: Bureau of the Census

...and surplus in chemical trade continues to expand



Western Europe



Prices are lower and chemical firms look for slower growth in demand but no recession next year

Patricia L. Layman
C&EN London

According to Hans Albers, chairman of West Germany's BASF, "The slower growth rates that we have long predicted have now become reality, but there is no reason for pessimism. The chances for business conditions to remain favorable in 1990 are very good." Speaking at a BASF press conference in Ludwigshafen late last month, Albers forecast that 1990 won't be bad at all. And coming after 1989, that is saying quite a bit.

For the chemical industry in Western Europe, 1989 was a remarkable year—a year, in fact, when management throughout the industry came to grips with a most welcome blessing: good times.

It's not that 1989 just ushered in an upturn in business. The year saw chemical production grow roughly 4% from 1988, which had been generally acknowledged as the all-time best year for the petrochemical industry. In 1983, chemical production in Western Europe was up 7% over that in 1987, which itself had been, in turn, a particularly good

Optimism prevails although a mild downturn is likely

year. Moreover, in 1988, profitability was extraordinarily high, as surging demand pushed capacity utilization to its upper limits for many products, with resulting firm selling prices and high profit margins.

This year, chemical company managements are looking ahead optimistically for sales growth, for higher investment, and for serious strategic planning. Now, 1990 is shaping up as the year of hitting stride in West Europe's chemical industry. Forecasters agree that a downturn must come eventually—but not this coming year.

According to the Brussels-based European Chemical Industry Federation (CEFIC), nearly all of the chemical industries of its member countries still see growth ahead in chemical output during 1990. Last year, CEFIC forecast that overall chemical production would be up about 3% over 1988; actual growth will be closer to 4%. Now, CEFIC is predicting that overall growth in chemical output next year will match that 4%. Says Hugo Lever, CEFIC's general director, "We believe any recession will be quite a mild one. There will not be a tremendous dip."

In fact, Lever is being particularly cautious—most chemical companies are not forecasting recession at all for 1990. A slowdown in growth, perhaps, but no actual decrease in production.

Whatever happens in 1990, of course, will reflect roughly the same conditions that influenced business performance in 1989, just as 1989 followed from 1988. Prices were at an all-time peak in 1988 for many commodity chemicals, points out Neville Pinnington, senior division head for bulk petrochemicals at Shell International Chemical in London. But in 1989 the more ex-

travagant prices came back down. Such prices were so high they were unstable, and such conditions could not last. It was inevitable for prices to fall. A similar point was being made by nearly all company officials all through the year.

It was perhaps surprising, in fact, that the year turned out as well as it did. Say economists at ICI, the British chemical giant, "Overall economic performance in the European economies has in total been rather better than expected a year ago." Their counterparts at BP Chemicals add, "The principal driving force has been the high level of investment and buoyant international trade."

Sometimes, general economic conditions benefited the chemical industry through 1989; sometimes they hindered it. Fluctuation of the U.S. dollar, for example, was a two-edged sword. Many of the industry's feedstocks are priced in dollars; as the dollar appreciated in value during the first half of the year, feedstocks became relatively more expensive to buy with European currencies.

Rising feedstock costs hurt downstream production economics, with "serious repercussions," as an executive with Italy's Montedison puts it. On the other hand, sales transacted in dollars—by U.S. subsidiaries, for example—become worth more in the home currency, adding nicely to total sales volume. Montedison first felt this impact in its pharmaceuticals business and then at its Himont subsidiary. Other companies with significant sales in North America, such as the Netherlands' Akzo and ICI, report a similar benefit.

Of course, there is the other side of the coin. Foreign subsidiaries of U.S. companies see their sales and profits shrink when translated back

into U.S. dollars when the dollar is strong. What the subsidiaries have to look to, says L. Blaine Boswell, president of PPG Europe, the European arm of PPG Industries, is that there is a good balance, within the country in which they are operating, between production costs and selling prices.

There is no denying the fact that prices throughout the chemical industry have dropped. One of the major reasons, believes Shell's Pinnington, is that since about the end of 1988 China—which had been buying significant quantities of petrochemical products—abruptly ceased doing so. One China-watcher says the decentralizing decisions within the country earlier in the decade had allowed for fragmented, uncoordinated purchasing, with no controlling hand watching hard-currency supplies. The country overpurchased, ran out of hard currency, and stopped buying.

That abrupt action, in turn, had a

snowball effect. Exporters who had been selling to China found that market shut off, so they turned more aggressively to their local markets, unsettling prices. "As prices fall, people destock," says Pinnington, in turn putting more pressure on prices. Buyers put off buying because they think that prices will continue to fall, and they also don't buy because they think their competitors also will put off buying.

The resulting price declines across the petrochemical industry have kept pressure on the Western European chemical industry to continue the restructuring and rationalization it had begun in the mid-1980s. Lower prices perhaps also have brought some investment planners back down to more solid ground from the blissful peaks of 1988. And that, in turn, might help prevent the chemical industry from embarking on another round of overcapacity.

Says one industry observer, "It's really not a bad thing that prices

have come down. We have had good times long enough that people were beginning to forget the past. For newcomers to the industry, that might be dangerous. If you just look back over the chemical industry to 1985, for example, you wouldn't see all the rollercoasters of 1974 to 1984. It's a bit dangerous if memories are too short. Some of the investment decisions will be cooled off, we think, and that is not a bad thing."

Executives throughout the chemical industry agree, because of the spectre of overcapacity. Too many went through the early part of the decade—with wildly excessive capacity, massive layoffs of employees, and restructurings—for them not to worry about the same thing happening once again. It took too many years for capacity utilization rates to move from 70 or 80% to the magical 90% or above, where a company really begins to make money on petrochemicals, for there not to be a lot of scars.

And, indeed, it has seemed during 1989 that chemical companies were embarking on a new round of building that would rapidly lower capacity utilization throughout the industry. Polypropylene producers, it can be argued, have already done that, so that as they move into 1990, they will be facing significant overcapacity. For other products, too, that prospect is all too real.

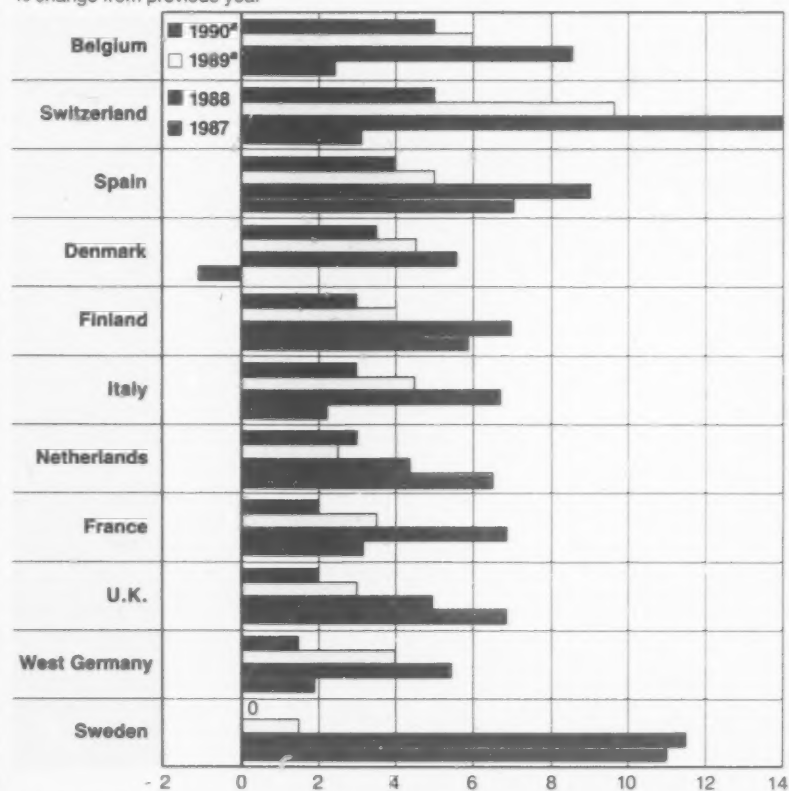
To some extent, companies are understandably matching their capital investment cycle to their business cycle. As David Culpin, a director of the U.K.'s Chemical Industries Association, points out, companies commit money to capital spending when they are making the money to commit.

Pierre-Yves Masson, president of Shell Chemical International Trading, adds that when companies have the money to spend, they must work to update their process technology and plant. They need the best technology available to maximize profit margins during good times and to be cost competitive when business turns down.

On the other hand, other executives in the industry argue, companies can't ignore conditions throughout the industry in their zeal to build new and better plants. One

Growth slows for chemical output in West Europe

% change from previous year



* Estimated. Sources: National chemical federations for each country

potential saving for the industry is the willingness to shut down old capacity when a new plant is built. There is some indication that the industry is increasingly ready to do that.

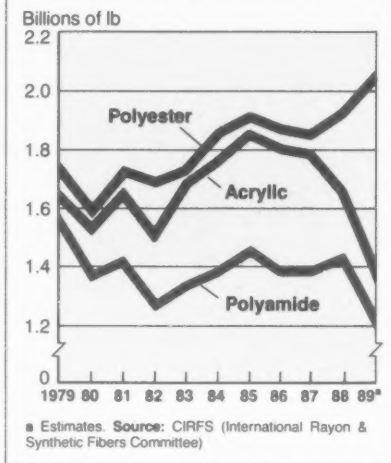
A case in point is the new polypropylene plant built by Appryl, a joint venture between Atochem of France and BP Chemicals, which built a new polypropylene plant with the intent of closing down the old one it replaced. Demand in the polypropylene market in Western Europe has been so good that it ran both, until the market finally began to cool down toward the end of this year; it is now closing the old plant, as originally planned.

Other sectors of the industry have also trimmed down radically. For example, during this past year, both ICI and West Germany's BASF have closed down fertilizer production or announced plans to do so. And West Germany's Hoechst has withdrawn from the fertilizer business entirely.

Still more trimming of capacity needs to be done in other sectors, many marketers agree. For example, Sir Christopher Hogg, chairman of Courtaulds, one of the major Western European producers of acrylic fibers, says acrylics won't move into solid profitability until more capacity throughout the industry is closed down. He was heartened by reports, earlier in 1989, that the two Italian fiber producers Snia-BPD (owned by Fiat Group) and Enimont were discussing links that might lead to the closing of some capacity. Since those early discussions, however, nothing has happened, and the acrylic fiber business is still suffering from both overcapacity and sagging consumer demand.

Disappointment that sectors of the fiber industry feel about the lack of any merger between Snia and Enimont has to be tempered by the fact that Enimont itself has come into being. The long-awaited merger of EniChem, the chemicals arm of the state-owned oil company ENI, with most of the chemical operations of privately held Montedison to create Enimont went into effect last January. And although there are still problems in meshing the two chem-

As polyester fiber output hits new high, others slump



ical businesses, because of a tortuous chain of Italian political and fiscal circumstances, Enimont now is a marketing and production force in Western Europe.

And in France, the chemical industry has been waiting since March for a major study by the Ministry of Industry about the industry's restructuring. This will be the second major restructuring of the decade, as most of the industry's major portions were nationalized in the early 1980s. Still not officially released, the study is predicted to call for the dismemberment of one company, Orkem (formerly CdF Chimie), with its assets dealt to the remaining big companies, Atochem (the chemicals arm of oil company Elf Aquitaine, which is 45% owned by the government), state-owned Rhône-Poulenc, and an enhanced chemicals group at the other state-owned oil company, Total.

The goal of the French restructuring is to improve responsiveness to the marketplace by getting closer to the customer. Consumer demand, of course, is the final arbiter, and the closer to the final customer, the more a chemical supplier must keep an eye on the general economy. For example, PPG's Boswell notes that his company in Western Europe is particularly linked with the automotive and construction industries. When those businesses are good, PPG's is, as well.

For example, he points out that

business in the automotive industry has been much stronger than economists had predicted. Auto production in 1988 hit 14 million, up 5% over 1987, and few people expected much further growth this year. However, output is up at least 2%, Boswell says. It won't be until 1990, he adds, that the automotive business will flatten out, or possibly even drop off 2%.

The closer one gets to the final consumer, also, the more environmentally responsive a company has had to be. This year, however, has been a year in which the environment—particularly waste disposal, including plastics waste disposal—has become a hot topic in Western Europe. Public concern and pressures have hit home to the point that industry has finally begun taking serious action to tackle new methods of waste disposal, for example, or develop alternatives to chlorofluorocarbons.

Biodegradability is one way to alleviate part of this problem. By early next year, for example, Montedison, working with its agroindustrial parent Ferruzzi, plans to introduce a new line of biodegradable plastics that will have a high starch content. "We must pay attention to development of nonpollution processes and production and to product quality," emphasizes a Montedison executive.

With momentum slowing but not stopping, it seems likely that there will be few dramatic changes ahead for the industry in Western Europe in 1990. Instead, it will be a year of continuation—of industry restructuring, rationalization, and diversification programs, in particular.

With the prospect of overcapacity looming, if not within Western Europe then elsewhere, marketers aware of restructuring needs will be increasingly willing to consider

Reprints of this C&EN special report will be available in black and white at \$5.00 per copy. For 10 or more copies, \$3.00 per copy. Send requests to: Distribution Room 210, American Chemical Society, 1155—16th St., N.W., Washington, D.C. 20036. On orders of \$20 or less, please send check or money order with request.

options such as joint ventures or shared production sites as a means of meeting needs without swamping the marketplace. The Finaneste cracker in Antwerp, due to come on stream in 1990 as a joint venture between Belgium's Petrofina and Finland's Neste, is perhaps the first in what will be a round of such joint projects.

One controlling factor will be the merger policy currently being worked out by the European Commission, which would play a transnational European role equivalent to that of U.S. antitrust authorities. For various reasons, the policy has been stuck in Brussels, as the commission addresses reservations held by the different member countries. But it is expected to be passed soon in the coming year.

The commission also will be concentrating its drive towards agreement on a social charter, which, among other things would bring worker representation to corporate boards of directors. Such a notion is being fought adamantly by the British government, although worker representation has been standard fare in other Western European countries for years.

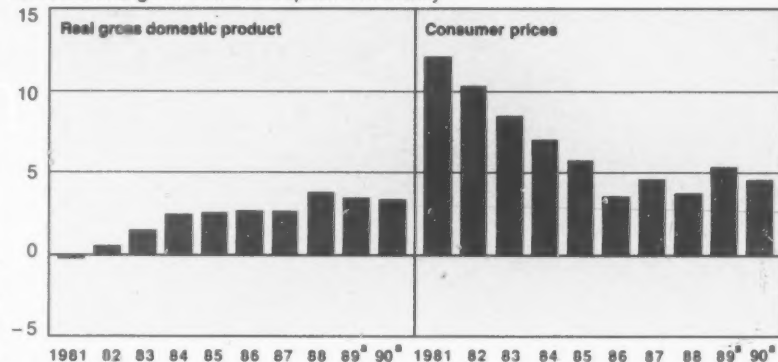
Points out Boswell of PPG, which has worker representation on the boards of its West German and Dutch subsidiaries, "most responsible managements, in making important business decisions, will have the welfare of employees as a major concern. Representation on the board brings it up to a more senior level." However, he adds, "dialogue just at the board level would be ineffective—the key is day-to-day dialogue, in a more open environment. That is healthy."

Despite the current continuing good profitability of petrochemicals, chemical companies continue their drive toward diversification, as a cushion against future downturns. As BP Chemicals' economists point out, "The current strong funds flow from petrochemicals provides the means to consider, as an option, further moves into specialties."

Investment will continue in capital assets or corporate acquisitions, virtually independently of whatever is happening to currency exchange rates. One Akzo executive

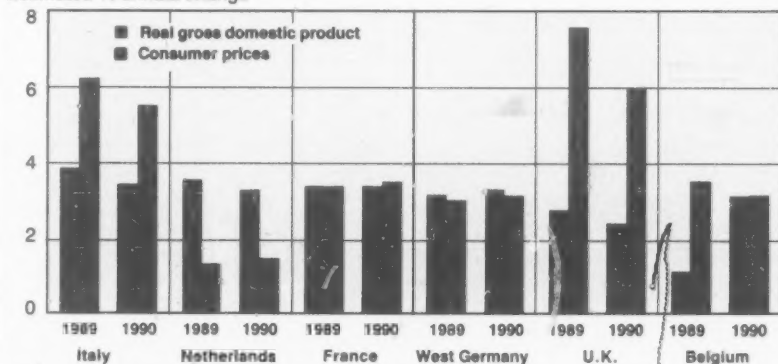
Economic expansion holds steady while inflation eases...

% annual change for overall European Community



...with growth in GDP expected to be slowest in U.K. in '90

Estimated % annual change



Estimated. Sources: Commission of the European Community, Barclays Bank

explains, "The dollar does not influence our plans to make acquisitions in the U.S. (or elsewhere). Our strategy, and the opportunity to make an acquisition that fits into this strategy, are dominant." At Akzo, that strategy aims "at a well-balanced product mix. Petrochemicals in general may have been very profitable lately, but we think that in the long run, a well-balanced product mix is to be preferred."

That philosophy is echoed by Bayer of West Germany. A spokesman notes, "Acquisitions made by Bayer in the U.S. are part of long-term strategic planning, and are not affected by short-term fluctuations. One major factor in acquisitions, however, is the current high price of U.S. companies, due primarily to the takeover fever which has gripped the U.S."

In general, Bayer's acquisitions are strategic, to broaden its presence in the global market or gain market

share in a product sector, as with its acquisition of the medical diagnostics company Cooper Technicon in 1989. Adds the company, "We prefer to opt for high, stable earning rates in the long term (with specialties) rather than very high earnings some years and lower earnings in others (in commodities)."

The prospects for 1990, therefore, seem to be more of the same, but at a slightly less brisk pace. On the assumption, though, that production of commodity chemicals trails slightly that of chemical products closer to the consumer, the industry may find some encouragement in the prediction of PPG Industries, with its auto and construction-sensitive businesses. "We see 1990 as a soft landing year," says Boswell, "maybe with a bit of a pickup for 1991. There is a potential falling off—a mild downturn, then business will come back. It's just part of the cycle." □

Japan



Demand continues strong, but chemical producers find costs now rising faster than selling prices

Earl V. Anderson
C&EN Northeast News Bureau

Japanese chemical companies may soon have to tighten their belts. Increasingly, signs point to a slow-down in the high-flying Japanese economy, which is likely to result in slacker demand for chemical products and bring an end to the

Surge in chemical profits will ease as economy slows

soaring profits that Japanese chemical companies have enjoyed for the past two years.

This does not mean that the Japanese chemical industry will have to suffer through hard times, as it did during the 1982 recession. It means only that the good times may not be quite so good as they have been for the past two years.

A recent survey conducted by the Japan Chemical Industry Association (JCIA) bears this out. According to JCIA, industry sales increased during the quarter ending last September (the second quarter of Japan's 1989 fiscal year, which ends in March 1990). But, for the second consecutive quarter, sales were not so high as estimated earlier.

Many Japanese chemical executives who responded to the survey think that present business conditions, which they characterize as "favorable," will continue at least through the end of next March. However, an increasing number of them believe that conditions could

take a turn for the worse by the end of this year.

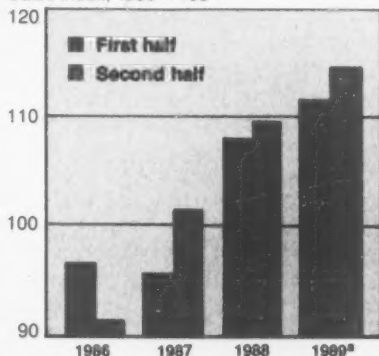
In fact, compared with past JCIA surveys, fewer chemical company executives believe that present business conditions are favorable. An increasing number now complain that raw material and operating costs are rising faster than selling prices, dimming the short-term profit outlook. They label business conditions as "moderate" to "bad."

Those terms, of course, are highly subjective. But a more quantitative measure seems to confirm that Japanese chemical companies are facing, if not bad times, at least tougher times. This measure is the sales and earnings estimates of 12 leading Japanese chemical companies made by Toyo Keizai Inc., a leading Japanese financial publisher.

Its estimates indicate that sales of the 12 companies were up an average 3% in the first half of fiscal 1989 and likely will increase another 4% in the half that will end next March. However, net income of the

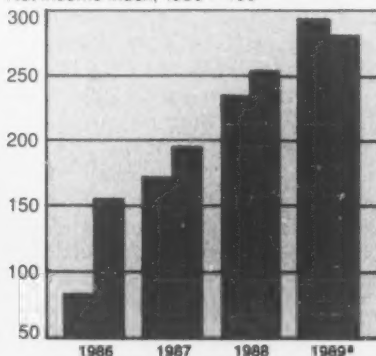
As sales edge higher for chemical producers ...

Sales index, 1980 = 100



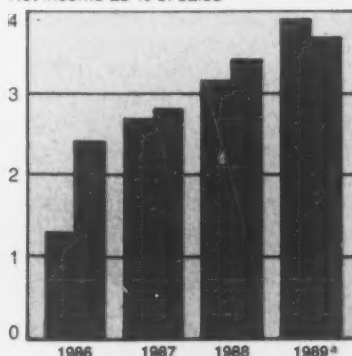
... profits make another strong advance this year ...

Net income index, 1980 = 100



... further widening the industry's profit margin

Net income as % of sales



Note: Based on the results of 12 leading Japanese chemical companies: Asahi Chemical Industry, Dainippon Ink & Chemicals, Hitachi Chemical, Mitsubishi Kasai, Mitsubishi Petrochemicals, Mitsui Toatsu Chemicals, Sekisui Chemical, Showa Denko, Sumitomo Chemical, Takeda Chemical Industries, Teijin, and Toray Industries. The fiscal year for most, but not all, of these Japanese companies ends March 31 of the following year. ^a Estimated for second half. Source: Toyo Keizai, Shinposha

companies, which advanced almost 26% in the first half, will be up only 13% in the second half.

That's hardly a doomsday outlook. But it does indicate that, in the Japanese chemical industry, profits will be harder to come by as the overall economy downshifts from rapid to a more moderate growth.

According to most Japanese economists, the country's economic growth rate is slowing down and will continue to slow down throughout 1990. Japan's fast-paced economic growth started in late 1986 when Yasuhiro Nakasone, then prime minister, launched a massive spending program on public works. Growth has been kept at a fast pace by strong housing construction, heavy capital investments, and soaring consumer spending.

Now housing starts are moderating. And according to Japan's Economic Planning Agency, the consumer buying binge, although still high, is starting to plateau.

Three other pillars that have helped to support Japan's economic growth over the past two years have been a stronger yen, low interest rates, and inexpensive oil. But the yen is weakening. It has gone from 123 yen per U.S. dollar at the beginning of the year to 143 yen per dollar at the end of last month. That 12% shift is significant, because it makes imported raw materials more expensive for Japanese companies.

Meanwhile, oil prices, critical to a country that imports virtually all of its oil, have been going up. Prices for crude imported into Japan have risen about \$5 per barrel this year and now stand at about \$16 per bbl.

Interest rates, too, are going up. The Bank of Japan has raised the official discount rate 1.25 points to 3.75% this year. Although that is low compared with interest rates in the U.S., any hike tends to put a damper on economic growth.

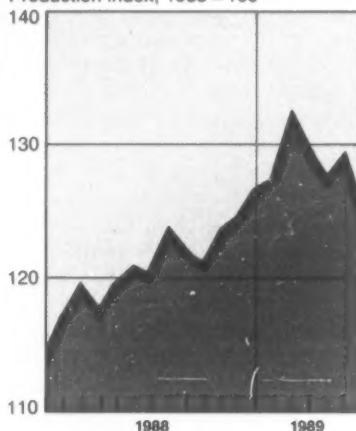
The one part of the growth equation that probably will remain intact is capital spending. More than half of 50 Japanese companies surveyed on their fiscal 1990 plans say they expect to increase capital spending. Only five indicated that they would cut it.

The U.S., with whom Japan has had more than its share of trade

Japanese chemical output generally strong again in 1989

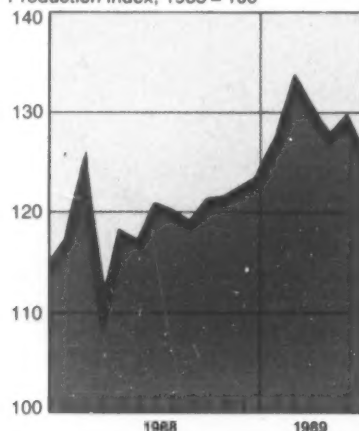
All chemicals

Production index, 1985 = 100^a



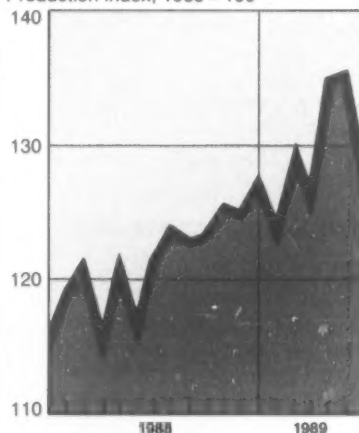
Petrochemicals

Production index, 1985 = 100^a



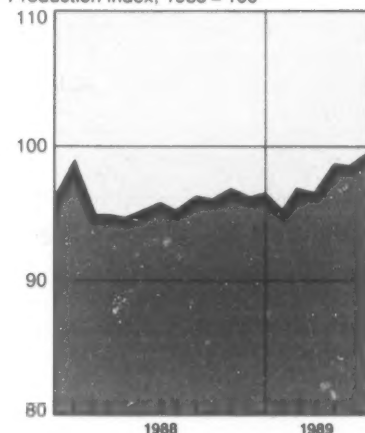
Plastics

Production index, 1985 = 100^a



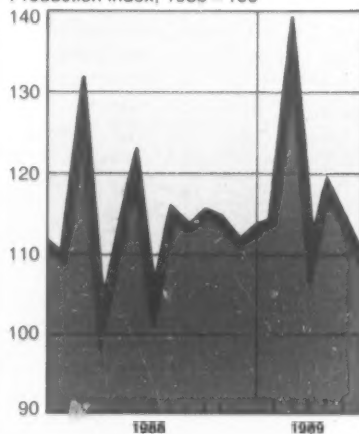
Synthetic fibers

Production index, 1985 = 100^a



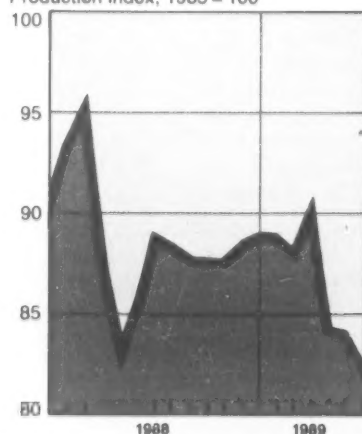
Synthetic rubber

Production index, 1985 = 100^a



Fertilizers

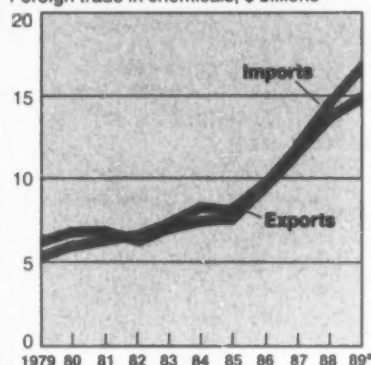
Production index, 1985 = 100^a



^a Seasonally adjusted. Source: Ministry of International Trade & Industry

Spurt in imports worsens chemical trade balance

Foreign trade in chemicals, \$ billions



■ C&EN estimates.

Source: Ministry of International Trade & Industry

squabbles, has expressed concern about Japan's heavy capital expenditures. The U.S. is afraid that such outlays may lead to overcapacity, then overproduction, and, subsequently, to a new surge in Japanese exports.

Sensitive to foreign criticism of huge trade surpluses, the Ministry

of International Trade & Industry (MITI) plans to launch a program next April to encourage imports of manufactured products. Among other things, it will offer tax incentives and low-cost loans to Japanese companies that import more foreign products.

Japanese business executives insist that most of their investments are aimed at meeting domestic demand, not at launching a new export offensive. This certainly seems to be the case for the chemical industry. Japan's chemical trade balance has been in the red every year since 1982. This year will be no exception.

In fact, the country's chemical trade deficit will just about double this year to \$1.7 billion. That's because chemical exports are likely to increase only 7% to \$15 billion, while chemical imports will jump almost 13% to \$16.7 billion.

Because imported chemicals already represent a substantial part of domestic supply, some Japanese chemical companies are wary of MITI's plan to encourage additional imports. They argue that if compe-

tition from imports becomes too intense it could pressure Japanese chemical companies into beefing up their export business. That would only help to increase Japan's overall trade surplus, which is exactly what MITI doesn't want to happen.

Meanwhile, with the exception of fertilizer and synthetic rubber, Japan's chemical industry continues to chug along on the wings of the country's still-strong economy. The petrochemical segment has been particularly robust. Production of ethylene, the bellwether of the industry, probably will hit a record high, topping 5.5 million metric tons. Last year's output was 5.2 million metric tons.

Japan's ethylene capacity is now about 6 million metric tons per year. Plans are in the works for six new ethylene plants, but chances are that not all of them will be built. MITI, taking a go-slow approach, is pressuring the industry to scale back its ethylene construction plans. It doesn't want to see a basic industry such as petrochemicals fall back into the overcapacity trap. □

Organics and plastics are outpacing inorganics this year

Thousands of metric tons unless otherwise indicated	1988	Seven months		% change
	1989	1988		
INORGANIC CHEMICALS				
Ammonia	1817	1065	1050	1%
Ammonium chloride	299	173	178	-4
Ammonium sulfate	1834	1006	1062	-5
Calcium carbide	342	220	224	-2
Calcium superphosphate	476	274	287	-5
Carbon black	720	448	417	7
Chlorine, liquid	979	603	576	5
Hydrochloric acid	565	325	328	-1
Nitrogen ^a	6940	4480	4005	12
Oxygen ^a	7707	4752	4450	7
Sodium carbonate	1083	651	630	3
Sodium hydroxide	3508	2097	2017	4
Sodium silicate	721	421	400	5
Sulfuric acid	6766	3990	3915	2
Titanium dioxide	258	161	149	8
ORGANIC CHEMICALS				
Acetaldehyde	333	203	194	5
Acetic acid	402	231	225	3
Acetone	289	190	172	11
Acrylonitrile	600	352	344	2
Benzene ^b	2374	1565	1364	15
Butadiene	780	473	441	7
Butanol	276	164	154	7
Caprolactam	493	276	291	-5

Thousands of metric tons unless otherwise indicated	1988	Seven months		% change
	1989	1988		
Cyclohexane	561	385	342	13
Diethyl phthalate	273	169	152	11
Ethylene	5162	3177	2861	11
Ethylene dichloride	2301	1405	1289	9
Ethylene glycol	349	282	213	32
Ethylene oxide	510	370	299	24
Methanol	141	47	117	-60
Octanol	273	155	147	5
Phenol	358	239	216	11
Phthalic anhydride ^b	171	92	98	-6
Propylene	3682	2294	2098	9
Propylene glycol	265	161	151	6
Styrene	1757	1147	969	18
Terephthalic acid	1150	702	678	4
Toluene	1019	602	607	-1
Toluene diisocyanate	96	56	50	12
Urea	790	458	469	-2
Xylene	1988	1408	1131	25
PLASTICS				
Phenolic resins	356	219	206	6
Polyethylene	2380	1513	1324	14
Polypropylene	1559	966	883	9
Polystyrene	1891	1140	1057	8
Polyvinyl chloride	1838	1125	1034	9
SYNTHETIC RUBBER				
	1299	789	758	4

^a Millions of cubic meters. ^b Petroleum-based product only. Source: Ministry of International Trade & Industry

Canada



Earnings are being undercut by lower prices while falling exports put trade balance into red

Earl V. Anderson
C&EN Northeast News Bureau

The Canadian chemical industry is starting to feel the impact of softer markets and a stronger Canadian dollar, which is hurting chemical exports.

For some major chemicals, production is declining. For others, growth in output is slowing noticeably. Sales and earnings of most Canadian chemical companies are weakening. Prices are lower. And Canada's chemical trade balance has turned around completely—from a \$400 million surplus (in U.S. dollars; \$1.00 = \$1.19 Canadian dollars on average for the first nine months of 1989) in 1988 to a \$757 million deficit this year.

What's more, little relief is in sight for the next two or three quarters. Demand is expected to remain sluggish for at least that long. And, if that turns out to be the case, Canadian chemical companies will be hard-pressed to improve their faltering earnings.

Earnings are, indeed, faltering. At Celanese Canada, profits are down 0.3% through the first nine months, despite a healthy 14% gain in the first quarter. Du Pont Canada's earnings, which fell in the first and second quarters from a year earlier, dropped a hefty 30% in the third

Markets for chemicals soften at home and abroad

quarter and are off 17% for the year through September.

At Union Carbide Canada, the story is similar. After chalking up a whopping 80% increase during the first quarter from 1988's like period, profits plummeted 64% during the third quarter. For the first nine months, Carbide Canada's earnings are off 12%.

Carbide Canada's chairman W. Norman Kissick blames sharply lower ethylene and polyethylene prices for his company's earnings decline. Du Pont Canada also points the finger at lower polyethylene prices, as well as lower sales volumes for polyethylene and carpet fibers. At Celanese Canada, the culprit is methanol. Lower methanol prices, which started showing up in the second quarter, contributed strongly to the company's lower net income.

The story repeats itself throughout the Canadian chemical industry. Lower prices for styrene and its polymers worldwide have hit Shell Canada Chemical's earnings. And

Sheritt Gordon's fertilizer division suffered a loss in the third quarter, primarily because of sharply lower urea prices in export markets.

Nova Corp., which became a petrochemical kingpin in Canada since it acquired Polysar Energy & Chemical last year, is particularly hard hit. The big reason: Basic petrochemicals now account for about two thirds of Nova's earnings, and since early in the year prices for its petrochemical products have gone down an average 30 to 35%. Nova's third-quarter income from petrochemical operations was only \$41 million this year, sharply lower than last year's \$203 million.

Little surprise, then, that Nova has decided to delay construction of a third ethylene plant at Joffre, Alberta, and has put on hold plans to build a new linear low-density polyethylene plant there. Nova, which already operates two ethylene units at Joffre with a combined capacity of 1.36 million metric tons, originally planned to bring its third

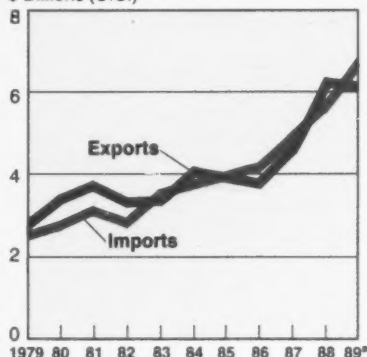
Signs of weakness show up in chemical production

Thousands of metric tons	Production					% change 1989-88
	1989 ^a	1988	1987	1986	1985	
Ammonia	4300	4010	3512	3540	3620	7
Ammonium nitrate	1085	981	844	948	1054	11
Ammonium phosphate	1010	986	941	1149	1301	2
Benzene	690	695	720	635	588	1
Chlorine	1615	1664	1635	1536	1424	-3
Ethylene	2400	2346	2140	1909	1744	2
Hydrochloric acid, 100%	180	180	164	153	158	0
Phosphoric acid, 100%	500	475	464	547	627	5
Polyethylene, high density	305	311	269	242	229	-2
Polyethylene, low density	990	1105	1021	887	733	-10
Propylene	760	669	628	628	648	14
Sodium chloride	585	503	432	373	336	16
Sodium hydroxide	1595	1720	1770	1696	1589	-7
Sulfuric acid	3680	3805	3437	3536	3890	-3
Urea	2500	2372	2142	2330	2033	5

^a C&EN estimates. Source: Statistics Canada

Chemical trade balance slips into red this year

\$ Billions (U.S.)



■ C&EN estimates. Source: Statistics Canada

unit on stream in the fall of 1992 with a capacity of 680,000 metric tons. That planned capacity was later shaved to 540,000 metric tons.

Meanwhile, in British Columbia, Westcoast Energy and its partners also have deferred work on a petrochemical project that they planned to build at Taylor. The project would have included a 340,000-metric-ton ethylene plant, as well as plants to produce polyethylene and ethylene glycol.

These two moves will help keep ethylene supplies from far outdistancing demand in the early 1990s because Canadian ethylene capacity is slated to increase even without the Nova and Westcoast plants. Dow

Chemical Canada, for instance, is building a 500,000-metric-ton unit at Fort Saskatchewan, Alberta. Polysar is expanding ethylene capacity at Sarnia, Ontario, by 90,000 metric tons. In Quebec, Pétromont is adding 45,000 metric tons to its Varennes capacity and is even considering doubling capacity there.

Canadian ethylene producers have been operating their plants at or near capacity, at least through August, the latest month for which production statistics are available. Nevertheless, output by year's end should reach no more than 2.4 million metric tons, only 2% higher than last year.

Canadian ethylene output, however, could go higher as a result of the explosion at Phillips 66's high-density polyethylene (HDPE) plant in Pasadena, Tex. That accident wiped out an estimated 16 to 17% of U.S. HDPE capacity, and Canadian producers are logical contenders to make up some of the shortfall.

Through the first eight months of the year, Canadian HDPE production was running 2% behind last year's pace. At that rate, it would close the year at 305,000 metric tons. That figure is likely to rise only if Canadian HDPE producers are able to take up some of the slack in the U.S. market.

Meanwhile, output of low-density polyethylene (LDPE), including linear low-density material, is faring

even worse. Output for the year will probably be down 10% to 990,000 metric tons.

One reason for the decline in Canadian ethylene derivatives production no doubt is the softer demand overseas. For most petrochemicals, Canadian capacity far exceeds domestic demand. As a result, producers depend heavily upon strong export markets.

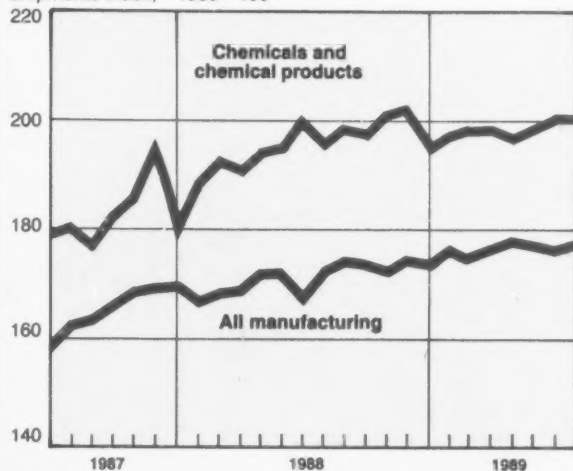
But those strong export markets aren't there this year. Exports of synthetic rubber and plastics are running 10% lower than last year. Meanwhile, inorganic chemical exports are down 12 to 18%, and fertilizer exports are off 8%.

The bottom line is that Canadian chemical exports are likely to decline 6% this year to \$6.1 billion, while imports will increase 13% to \$6.8 billion. Despite the many fingers that will be pointed at the Canada-U.S. trade pact, the real reason for the disparity is that worldwide demand for Canadian chemicals has lost some of its strength.

A major factor in this export weakness is the strong Canadian dollar, which makes Canadian products more expensive in world markets. And as long as the Bank of Canada keeps interest rates high to combat inflation, the Canadian dollar will remain strong and Canadian chemical companies will find competing in the world marketplace more difficult. □

Growth of chemical shipments slows...

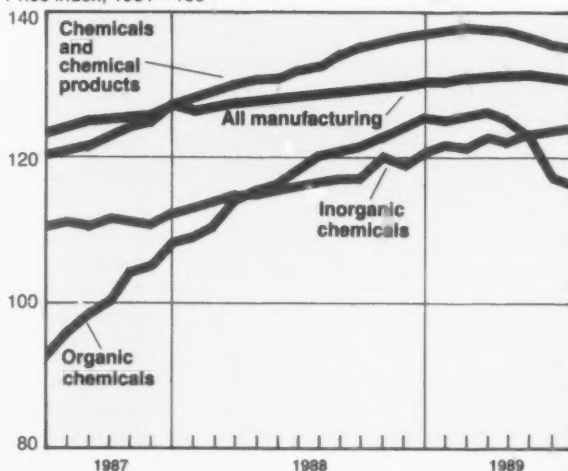
Shipments index,^a 1980 = 100



■ Seasonally adjusted. Source: Index based on Statistics Canada shipments data

...as organic chemical prices soften

Price index, 1981 = 100



U.S.S.R./Eastern Europe



Soviet, East European chemical industries need massive efforts to overcome deeply rooted stagnation

Richard J. Seltzer, C&EN Washington

For years, the economies of the Soviet Union and its East European allies—Bulgaria, Czechoslovakia, East Germany, Hungary, Poland, and Romania—have displayed increasing stagnation, plagued by structural problems deeply rooted in their centrally planned systems. Indeed, the resulting malaise contributed mightily to the political upheavals and wave of democratization that have swept all East Europe but Romania in recent months.

Sooner or later, the revolutionary euphoria will fade. But the East bloc nations still will face years of massive efforts to carry out fundamental changes, introduce market forces, build infrastructures, and transform systems and institutions. Rapid improvement in economic and industrial performance is thus unlikely. However, these efforts may well open up wide opportunities and challenges for Western industry through investments, joint ventures, and other links—with chemical industry probably playing a key role.

Gross industrial output for the region grew just over 2% through September this year, compared with 4% through September last year, according to a report by the United Nations Economic Commission for Europe. This weakening performance reflects a variety of supply constraints and transport bottlenecks, UNECE notes.

For one thing, strikes, interethnic conflicts, and a drop in labor and management discipline in the Soviet Union have caused raw material, equipment, and energy shortages. Exacerbated by Soviet transport problems, these shortages appear to be spilling over into neighboring economies through reduced exports.

Hungary, the U.S.S.R., and Poland are trying to fight inflation with austerity measures that likely will further slow industrial growth.

Indeed, Soviet president Mikhail S. Gorbachev's perestroika (restructuring) program, which ignited the blaze that has swept East Europe, "has yet to yield positive results," notes a recent report by WEFA Group (formerly Wharton Econometric Forecasting Associates). In fact, adds a report from PlanEcon

Soviet, East European output slows for some chemicals

Thousands of metric tons, 1988	U.S.S.R.	Bulgaria	Czechoslovakia	East Germany	Hungary	Poland
Mineral fertilizers^a	37,100	1134	1025	5192	900	2718
Change from 1987	2.1%	21.5%	4.2%	1.4%	0.8%	3.7%
Nitrogen (N)	15,800	956	596	1382	na	1622
Change from 1987	0.4%	18.8%	0%	4.9%	na	5.1%
Phosphate (P₂O₅)	10,000 ^b	178	313 ^b	300 ^b	na	962
Change from 1987	3.2%	39.1%	13.0%	3.0%	na	2.1%
Potassium (K₂O)	11,300 ^c	0	116 ^c	3510	na	134 ^c
Change from 1987	3.6%	—	4.6%	0%	na	--2.2%
Sulfuric acid	29,400	780	1249	799	512	3154
Change from 1987	3.0%	13.2%	-1.2%	-7.8%	-10.6%	0.2%
Ammonia^d	20,330	1336	774	1160	na	1923
Change from 1987	2.0%	24.9%	-0.8%	-1.7%	na	7.4%
Plastics	5,672 ^e	344	1180	1149	600	723
Change from 1987	3.4%	6.8%	2.4%	8.3%	11.3%	12.8%
Sodium hydroxide	3,324	129	337	627	202 ^f	444
Change from 1987	1.1%	24.0%	-2.0%	8.6%	0.3%	5.2%
Synthetic rubber	2,485	24	77	104	—	127
Change from 1987	5.0%	0%	1.3%	5.1%	—	8.5%

Note: Romania is not included because data are unavailable. ^a Nutrient content basis. ^b Includes ground phosphate for direct application and phosphate animal feeds. ^c Imported potash added to domestically produced nitrogen and phosphate to form multinutrient fertilizer. ^d Nitrogen content basis. ^e Includes resins for man-made fibers. ^f Includes regenerated NaOH. na = not available. Sources: PlanEcon Inc., Central Intelligence Agency, state central statistical bureaus.

Inc., a Washington, D.C.-based firm specializing in research on the Soviet and East European economies, perestroika, "while politically and socially exciting, is proving disastrous for the Soviet economy."

Soviet industry stagnated in 1988, with major sectors showing no growth in real terms. Industrial production rose just 2.4% by Central Intelligence Agency calculations (correcting the Soviet figure of 3.9% to eliminate upward bias due to double-counting and disguised inflation). This fell below the target of 4.4%. Chemical growth in 1988 was just 1.8% by CIA figures.

This year, through September, the Soviet figure for industrial growth is only 2.2%, compared with a target of 3.1%. All sectors fell short of their targets, with the "chemical and timber complex" up just 1.9% by Soviet figures. The third quarter was even worse than the first six months, notes Zuzana Princova, director of WEFA's centrally planned economies unit in London. The complex's output in the third quarter fell 9% below that in 1988.

The critical situation forced the Soviets to prepare a plan for 1990 that proposes a fundamental shift of resources, which would cut investment in heavy industry and construction 30% and redirect part to making consumer goods and part to reducing the large budget deficit.

In East Germany, one of East Europe's top chemical producers, economic growth also ground nearly to a halt in 1988, notes PlanEcon. Like East Germany's industry in general, the growth rate for the chemical sector, including rubber and plastics, has declined continually since the early 1970s. The sector is now growing at less than half the annual average of 8% it racked up from 1971 through 1975. Production of

sulfuric acid dropped 8% in 1988, for example, while output of hydrochloric acid was essentially unchanged and ammonia was down 2%.

The chemical industry has suffered from economic policies that have inhibited East German industry overall, notes PlanEcon. These policies included pushing exports (especially hard-currency exports) at any cost while neglecting not only investment and modernization but also the general infrastructure needed by industry to maintain high growth rates. Also hindering industrial operations have been expensive social policies—such as overspending on housing construction and price subsidies—and excessive dependence on dwindling domestic sources of energy.

East Europe's other top chemical producer is Czechoslovakia. Like East Germany, Czechoslovakia's overall industrial growth, as well as growth of its chemical industry, has slowed in the 1980s to less than half the rates in the early 1970s (an average 7% a year for 1971 through 1975 for all industry and 10% a year for chemicals and rubber). Industrial output overall rose just 2% in 1988 and only 1% in the first six months of 1989. Chemical output also grew just 2% in 1988. Production of a number of key chemicals dropped in 1988, including nitric acid (down 3%), sodium hydroxide (down 2%), and sulfuric acid and ammonia (both down about 1%).

Czech industry has not suffered from the type of macroeconomic adjustment forced in Hungary, Poland, and Romania by mounting foreign debt and economic policy flaws, points out PlanEcon. But, the firm says, "all of Czechoslovak industry, including the chemicals sector, is becoming increasingly obsolete and outmoded and is experiencing prob-

lems with improving both the quality and quantity of output."

East German and Czech chemical industries would be the most attractive in Eastern Europe to Western investors, notes Jay K. Mitchell, manager of Soviet and East European chemical services at PlanEcon. West German chemical firms have a great advantage, he points out. Economic and environmental cooperation between the two Germanies was already increasing markedly, even before the recent political upheaval. West Germany already takes about 60% of East Germany's trade with the West.

Of the East Bloc nations, Hungary is so far probably farthest along the path to comprehensive reform. However, says PlanEcon, worsening inflation and a growing foreign debt crisis, "along with government inability (until recently) to accept the necessity of radical, rather than hesitant, economic reforms" have resulted in generally poor Hungarian industrial performance since 1980.

Last year, for instance, overall industrial production dropped 0.4%, and through July of this year it dropped another 0.4%. Chemical output rose just 0.3% in 1988 and 0.8% through May of this year. Production dropped for several key chemicals in 1988, including sulfuric acid (down 11%) and pesticides (down 7%), and stayed nearly unchanged for others, such as caustic soda and mineral fertilizers.

However, political reforms, an aggressive privatization program, a stock market, and joint ventures have given new impetus to Hungary's modernization drive. For example, Hungary is offering 53 companies for foreign investment, including four chemical firms: Borsod Chemical Combine, Chinoin Pharmaceutical & Chemical Works, Pet Nitrogen Works, and Taurus Hungarian Rubber Works. General Electric last month spent \$150 million for a controlling interest in Tungsram, a Hungarian light bulb maker.

Poland's economic situation has deteriorated this year, following significant growth last year (industrial production was up 5% and chemical output up 6%). Inflation is accelerating (exceeding 200%), production is lagging, labor discipline is

East German chemical growth half that of early 1970s

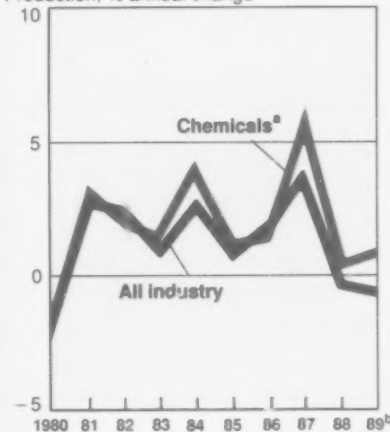
Chemical production, % annual change	1971-75	1976-80	1981-85	1986	1987	1988
All industry	6.3%	4.9%	4.1%	3.8%	3.2%	3.3%
All chemical industry ^a	8.3	4.8	3.8	2.2	2.6	3.5
Oil, gas, and coal-derived chemicals	7.7	4.4	3.9	1.4	3.6	1.7
Plastics	11.7	5.3	4.3	-1.8	-1.5	10.4
Man-made fibers	13.2	4.3	4.2	0.4	2.8	5.1

^a Includes rubber industry. Source: PlanEcon Inc.

East Europe's industrial production generally falling in 1989

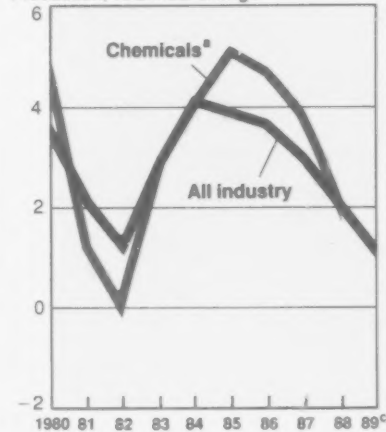
Hungary

Production, % annual change



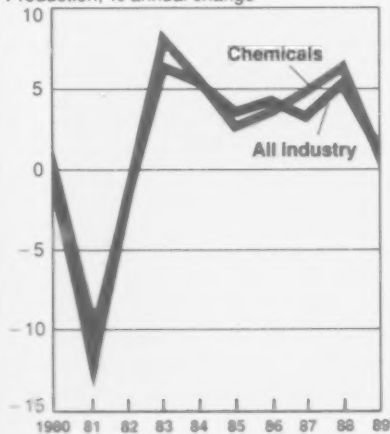
Czechoslovakia

Production, % annual change



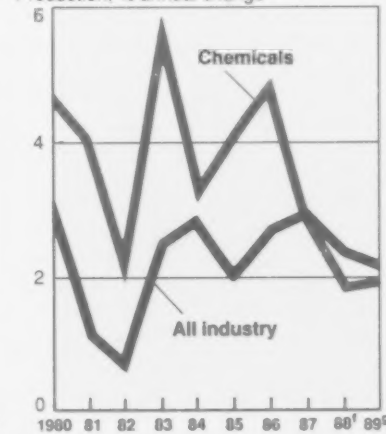
Poland

Production, % annual change



U.S.S.R.

Production, % annual change^e



^a Includes rubber industry. ^b For first five months. ^c All industry for first six months; chemical and rubber industry growth in 1989 is not available. ^d For first six months. ^e All Soviet Union figures except for 1989 are based on Central Intelligence Agency estimates, which are lower than official statistics. ^f Preliminary. ^g For first nine months; official Soviet figure for 1989 is for "chemical and timber complex," rather than chemical industry. Sources: PlanEcon Inc., Central Intelligence Agency, United Nations Economic Commission for Europe, state central statistics bureaus.

declining, and hard currency exports are falling short of targets. Industry output overall rose just 0.2% through July, while chemical production was up only 0.4% through June. July was disastrous, with industrial output down 6% versus July 1988 and chemical production down 10%.

The radical political changes Poland has undergone this year "have created unique opportunities" for solving its decade-long economic crisis, PlanEcon notes. But the changes "also have generated expectations which may prove hard to fulfill." Western aid, including that recently approved by the U.S.

Congress, is "still rather meager compared to what is needed," and Poland has not yet undertaken the economic reforms and austerity policies it needs. All in all, PlanEcon is more pessimistic regarding Poland's chances for radical economic reform than those of Hungary.

Bulgaria is a relatively minor chemical producer, and PlanEcon projects only limited gains during the next few years. This is partly a reflection of its size (less than 9 million population) and partly because its chemical industry is still in early stages of development.

For example, Bulgaria produces

relatively low amounts of products as sophisticated as plastics (344,000 metric tons in 1988) and man-made fibers (93,500 metric tons in 1987). Production of many chemicals, including plastics and fibers, actually has declined since the mid-1980s, despite swiftly rising imports of raw materials and intermediates from the West since 1985. And destruction of the Devnia polyvinyl chloride plant in late 1986 all but wiped out production of that plastic, with replacement not due for several years.

Bulgaria's industrial output rose 5% in 1988, as did its chemical output. Growth slowed to 3.5% and 3.3%, respectively, through September of this year.

Meanwhile, defying the waves of reform, Romania continues to go its increasingly isolated way under what PlanEcon calls "the mad schemes" of its authoritarian leader, Nicolae Ceausescu. Romania releases few detailed or reliable statistics, but what is known "clearly indicates the decline of the chemical industry," with output falling since 1985 for almost all products reported, PlanEcon says.

For example, in 1988 mineral fertilizer output was down 5%, plastics down 2%, sulfuric acid down 3%, and man-made fibers down 4%. Other chemicals probably have fared even worse, PlanEcon notes. Moreover, Romania has far fewer chemical facilities being supplied by Western firms than has any other East bloc nation, so it is likely falling increasingly behind not only world standards but even East European ones.

In March, the regime finally reached its goal of liquidating Romania's hard-currency debt—by slashing imports while boosting hard-currency exports. But deprived of domestic investment and foreign capital, the economy and industry suffered greatly. For instance, there has been little construction of new chemical plants or expansion of existing ones in recent years. Now that the foreign debt has officially been eliminated, Romania faces massive rebuilding to restore chemical capacity losses and overcome technological backwardness—if it gets desperately needed modernization funds from the "often irrational" Ceausescu, PlanEcon notes. □

China



Political crackdown and ongoing austerity program shape outlook for chemical and other industries

Richard J. Seltzer
C&EN Washington

China's economic and industrial environment is currently being shaped primarily by two forces: the political crackdown that began in Beijing's Tiananmen Square six months ago and the nation's austerity program.

The crackdown was a watershed event. Until June 4, U.S. and other foreign investment in joint ventures had been accelerating, including chemically related projects. In 1988, the number of new U.S. investment contracts doubled to close to 600 with a commitment value of almost

China puts reforms on hold as economic problems mount

\$3.5 billion. The 1988 total for all foreigner investors was almost \$5 billion, with projections of more than \$8 billion in 1989. Foreign executives saw a reformed investment regime, improved overall environment, and attitudes changing for the better among Chinese officials, notes Roger W. Sullivan, president of the U.S.-China Business Council.

Then came the crackdown, raising questions in foreign minds about China's stability and its commitment to a continuing process of liberalization, reform, and opening up to the world. Those who had projects in China have kept them going, but many considering investments have put them on hold.

U.S. experts differ on whether reform is essentially over. Some experts, such as Sullivan, depict Marxist-Leninist hardliners as "moving with remarkable speed and self-confidence to establish their dominance." Ironically at a time when East Europe is opening up, such leaders are taking their nation sharply backward, Sullivan believes, away from market forces and integration into the world economy and back toward Marxist central planning and greater political, ideological, and social control. Other specialists, such as Nicholas Lardy of the University of Washington, think reforms will continue and that the climate for foreign investment will improve after a period of consolidation.

In any case, a second major force acting on China's economy and industry is an austerity program imposed by its leaders. This program attempts to cool down soaring inflation, cut overly rapid industrial growth, and check increasing corruption and a deteriorating trade balance. The program has put economic reforms on hold for about a year already, although Chinese lead-

ers have reiterated their commitment to reform. However, observers suggest that under the guise of austerity, hardliners may try to chip away at market-oriented reforms.

In 1988, industrial output surged 21% and gross national product rose 11%. This intensified China's chronic energy and raw materials shortages and transportation bottlenecks, and pushed inflation to its highest level in nearly 40 years—19% for the nation overall and almost 30% in the cities. Chemical production in 1988 soared for a number of key chemicals. Ethylene production was up 47%, insecticides 28%, pharmaceuticals 26%, and sulfuric acid 14%.

As a result of the austerity program, inflation has indeed eased, but so has industrial production. Thus, industrial output grew 11% through July of this year, just half as much as in all 1988, and is continuing to weaken in the second half. One analyst predicts just 5% industrial growth for all 1989.

Output of ethylene was up 16% through July, insecticides 13%, and both pharmaceuticals and sulfuric acid 2%. However, the hardliners view inflation as the root cause behind popular dissatisfaction. They are ready to tolerate losses in economic activity and further unpopularity in hopes of achieving a more stable long-term price environment.

China's trade deficit also widened sharply last year, as it sought to import many industrial and agricultural products it couldn't supply domestically. For example, it sharply increased imports of fertilizer in the second half of 1988. U.S. fertilizer exports to China last year leaped 40% from 1987, to \$379 million. China also imported \$596 million worth of plastics and resins from the U.S. (up 134%) and \$257 million worth of organic chemicals (up 71%). □

China's output of plastics, fibers up sharply in 1989

Thousands of metric tons	1989 ^a	1988	% change 1988-89 ^a
Synthetic ammonia	11,834	19,725	1.3%
Fertilizer ^b	10,601	17,675	0
Sulfuric acid	6,594	10,981	2.3
Sodium hydroxide	1,847	2,925	8.1
Sodium carbonate	1,597	2,593	2.2
Plastics	1,192	1,552	31.3
Man-made fibers	864	1,284	18.5
Ethylene	830	1,231	16.1
Benzene	340	566	2.5
Synthetic rubber	173	251	13.2
Pesticides	140	202	12.7
Pharmaceuticals	114	194	2.4

^a For first seven months. ^b Nutrient content basis. Sources: State Statistical Bureau of the People's Republic of China, China Economic News